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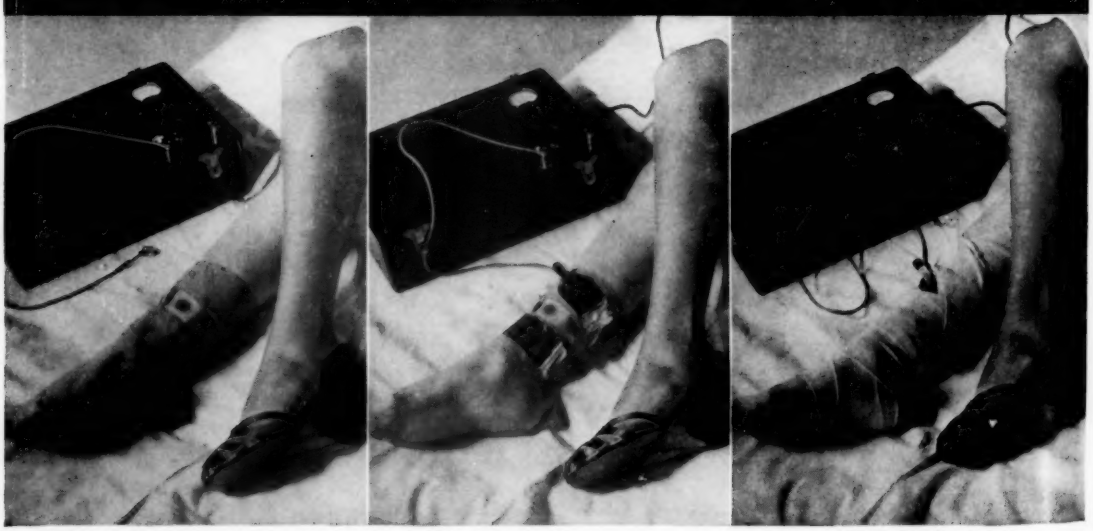

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THE TREATMENT OF NEUROSYPHILIS BY ARTIFICIAL FEVER-CHEMOTHERAPY

H. WORLEY KENDELL, M.D.*
WALTER M. SIMPSON, M.D.**
and
DONALD L. ROSE, M.D.***

DAYTON, OHIO

The past ten years have brought about a marked increase of interest in the use of physically induced fever for the treatment of neurosyphilis. Statistics show the results to be similar to those obtained with malaria therapy. The early hyperenthusiastic and sometimes extravagant claims made by advocates of one method or the other have given way to a more rational clarification of the relative merits of the two procedures.

It would be impossible to present all of the material that has been published on either malaria or artificial therapy in the treatment of neurosyphilis. The following is presented to show the rationale for the use of artificially induced fever and the results of our own experiences in the past ten years.

In the analysis presented in 1939 by Julius Wagner-Jauregg[1] which was published a short time before his death, are significant statements which bear considerable weight in view of the fact that Wagner-Jauregg was the father of malaria therapy. In this publication he stated:

> The method of treatment by elevation of body temperature to the height of fever by physical means has been used in a large number of diseases and has been shown to be very valuable. In so far as used in progressive paralysis the methods concur with malaria therapy. Results show that after treatment of progressive paralysis with physically induced fever there are remissions similar to those which occur in patients treated with malaria. Also many have found that treatment of paralysis with physically induced fever gave a number of full remissions as great or greater than with malaria. Furthermore, it is a well-known advantage of artificial fever that one can regulate the height of the temperature reached, the length of the fever periods and the length of the fever-free rest periods according to the condition of the patient. Moreover, during the course of treatment continuous hospitalization is not necessary. Also those sick people who can still continue their ordered business life require several weeks of interference with their work if malaria treatment is used. Finally, if following artificial fever and chemotherapy, the goal of treatment is not reached, namely, the production of negative spinal fluid, then one still has time to utilize malaria treatments.
>
> Admitting that experience has determined from a great amount of material that malaria and artificial fever combined with intensive treatment with pentavalent arsenicals gives on the average the same number, degree and length of remissions there must also be non-medical considerations in the choice of the method. One must observe the question from an economic standpoint. So far as the fever producing agents are concerned the malaria treatment has an unquestioned advantage. The little cubic centimeter of blood which is necessary for the treatment of paralytics costs nothing, and even supposing that the material for injection comes from another place, there is no important cost. Furthermore sick persons can be treated together in a room under supervision of a trained nurse or orderly. The artificial fever apparatus is costly. During the course of a treatment the uninterrupted presence of a person trained in the complex technic of the apparatus is necessary. Also only as many cases may be treated simultaneously as there is available equipment. Truly

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one advantage of the artificial fever treatment must be brought forward; namely, that it is innocuous compared to the danger of malaria treatment (as regards fatalities).

In 1936, approximately three years after Wagner-Jauregg's report appeared, Dr. Thomas Parran, Surgeon General of the United States Public Health Service, appointed a subcommittee of the Cooperative Clinical Group to study and to evaluate the various forms of nonspecific therapy used in the treatment of neurosyphilis. This committee was composed of Dr. Paul A. O'Leary,[2] Mayo Clinic, Rochester, Minn.; Dr. Walter L. Bruetsch, Central State Hospital, Indianapolis; Dr. Franklin G. Ebaugh, University of Colorado Psychopathic Hospital, Denver; Dr. Harry C. Solomon, Boston Psychopathic Hospital, Boston; Dr. Stanford L. Warren, University of Rochester, Rochester, N. Y., and this group at the Miami Valley Hospital, Dayton, Ohio. All had had extensive experience with either malaria therapy or artificial fever therapy or with both. In addition to the above, the following clinic directors offered for analysis the records from their institutions: Dr. A. E. Bennett, University of Nebraska, Omaha; Dr. Harold N. Cole, Western Reserve University, Cleveland; Dr. J. R. Blalock and Dr. Leland E. Hinsie, New York State Psychiatric Institute, New York city; Dr. Frank R. Menaugh, Henry Ford Hospital, Detroit, and Capt. Ernest H. Parsons, M.D., United States Army, Fitzsimons General Hospital, Denver.

The report of the committee on "Malaria and Artificial Fever in the Treatment of Paresis," appeared in August, 1940. The study was designed to compare the therapeutic results obtained by the use of artificial fever produced by physical methods with those obtained by the use of inoculated malaria in the treatment of dementia paralytica. The results were evaluated in terms of both clinical and serologic responses observed after the independent use of either method of fever therapy, with or without the associated employment of chemotherapy.

Only patients who had been observed for more than two years after following the commencement of fever therapy were considered. The records of 1,420 such patients were pooled for statistical study. Of these, 1,100 patients were treated with malaria and 320 with artificial fever.

As regards patients with "mild" or "intermediate" dementia paralytica, there were no statistically significant differences between the rates of remission obtained with malaria therapy and those obtained with artificial fever therapy. (In other words, equally good clinical results were obtained with either method of fever therapy in patients with mild or intermediate dementia paralytica.) Sharp and statistically reliable differences were noted, however, between the results of the two methods of therapy among patients suffering from severe dementia paralytica at the beginning of fever therapy; here there was a distinct superiority of remission rates following artificial fever therapy.

For the purposes of the study, treatment deaths were defined to include not only those occurring during the course of fever therapy but those occurring during the succeeding three months, regardless of cause. With such criteria utilized, the total death rate was higher with malaria (13 per cent) than with artificial fever (8 per cent).

The necessity for employing auxiliary chemotherapy with either method of fever therapy was indicated both by the significantly higher proportion of spinal fluid reversals and by the maintenance of such reversals in patients receiving concomitant or subsequent chemotherapy or both. The reversal rates of blood and spinal fluid were approximately twice as great with as without the use of auxiliary chemotherapy.

The highest percentage of clinical remissions was obtained in the two groups of patients who experienced either an average of sixty-nine hours of fever above 101 F., of which 70 per cent were at a level above 105 F. with a maximum temperature of 106.9 F., or in those who received an average of forty-four hours of fever above 101 F., of which total time 57 per cent were above 106 F. with a maximum temperature of 107 F.

The excellent comparative study carried out by Barnacle, Ebaugh and Ewalt,[3] of the University of Colorado, on the treatment of dementia paralytica with artificial fever and malaria, bears mention. A five year comparative study of artificial fever therapy and malaria therapy based on the alternate assignment of 232 patients with dementia paralytica was made.

During the first three years of the investigation the patients treated with artificial fever received fifty hours of fever at a rectal temperature of 105 to 106 F., given as ten treatment sessions of five hours each. In the last two years of the study it was found that a series of twelve individual fever sessions of three hours each at a rectal temperature of 105.8 was equally effective and had the decided advantage of permitting the treatment of a greater number of patients.

These investigators found that intensive chemotherapy subsequent to fever therapy is an essential requirement for sustained optimum results. It is pertinent to observe that Ebaugh and Ewalt[4] have now abandoned malaria therapy in favor of artificial fever therapy.

Another interesting and important report is that of Bennett and associates,[5] of the University of Nebraska, at Omaha. The report deals with five years' experience in the treatment of neurosyphilis, and they reported that 81 per cent of the patients showed remission or were improved.

As a result of these studies the authors drew the following conclusions: that patients of advanced years or in poor physical condition, including those with such complications as hypertension or aortitis, can be treated with greater safety with artificial fever because the height and duration of fever can be controlled readily; that chemotherapy increases therapeutic effectiveness; that the prescribed number of hours of fever are more easily obtained by physical methods, and that a significant proportion of neurosyphilitic patients who fail to respond to malaria therapy or who obtain only moderate degrees of improvement with such treatment are benefited by subsequent artificial fever therapy.

Bromberg,[6] of Washington University, St. Louis, who treated 300 patients with artificial fever, reported that 76 patients treated for various manifestations of neurosyphilis showed results similar to those reported by Bennett and associates. Trautman,[7] of the United States Marine Hospital, New Orleans, reported on 109 patients treated for neurosyphilis. Neymann,[8] of Northwestern University, Chicago, has reported on 120 patients treated for dementia paralytica and has reported a survey by some fifty investigators on artificial fever therapy, in which 975 cases were evaluated. Hinsie and Blalock,[9] New York State Psychiatric Hospital, reported on 146 adult patients with dementia paralytica observed during a period of five and one-half years. All of the above-mentioned investigators reported similar remission rates in the treatment of various types of neurosyphilis.

The history and progress of our work in artificial fever therapy since its inception in 1931 has been recorded in several publications.[10] Impressed by the successful clinical results attained early in the course of the undertaking, despite the handicap of inefficient physical modalities then available, we decided that future researches should be directed along two separate but related routes; namely, toward the development of simpler, safer and more

easily controllable apparatus for the production of fever and toward an exploration of the possible fields of usefulness for this mode of treatment.

Coincident with the early engineering developments related to the apparatus, it was natural that the first clinical applications should be directed toward a determination of the possible usefulness of artificial fever therapy in the management of dementia paralytica. Wagner-Jauregg's successes with the treatment of this disease with malaria therapy had been widely confirmed. Comparable clinical results had also been obtained in those cases of dementia paralytica in which sustained high fever occurred after inoculations with organisms of rat bite fever and of relapsing fever or after injections of vaccines.

The first patients treated by us with artificial fever, produced by physical means, were those who were suffering from dementia paralytica. Despite the difficulties and discouragements encountered in the quest for suitable physical methods, it was observed from the start that the clinical results were at least comparable to those previously obtained with malaria therapy.

One advantage of the artificial fever method in contrast to malaria therapy is that arsenic and bismuth compounds may be administered with each fever treatment. Our observation that fever appeared to exert a protective function against anaphylactic phenomena produced in sensitized persons by arsenic led us to change from the practice of injecting the arsenical compound half an hour before each fever treatment was begun, to that of making the injection when the rectal temperature first reached the desired level. In our experience, patients who had previously been treated with arsenicals and had extensive and various types of sensitization reactions were treated with the combined fever chemotherapy without similar reactions. The observations fortified our belief in the protective effect of fever against the development of symptoms of sensitization to heavy metals. For purposes of comparison various arsenic compounds have been employed combined with artificial fever. One significant observation has come out of this comparative study; namely, that regardless of the type of arsenical compound used, and despite the great variation in arsenic content, the time required for clinical remission and for serologic reversal did not vary appreciably. Factors other than the quantitative arsenic content appear to operate in producing a favorable outcome. During the past five years we have utilized mapharsen exclusively. This has been given in doses of 0.04 or 0.06 Gm. combined with bismuth in the form of bismuth salicylate, the latter being injected immediately before the treatment session is begun.

During the first six years of this investigation, the usual course of treatment for neurosyphilitic patients consisted of ten five hour sessions of artificial fever therapy at 105 to 106 F., usually given at weekly intervals, for a total of fifty hours. After the course of combined fever therapy and chemotherapy was completed, the patients received an additional course of bismuth and arsenic injections, given concurrently, at weekly intervals for a period of twenty weeks.

During the past five years the five hour treatment was reduced to three hours and the total number of hours reduced from fifty to an average of thirty-six hours. In other words, the patients received twelve three hour sessions instead of five ten hour sessions. The same height of fever, that is 105 to 106 F., was maintained. For the most part, during the first six years the patients received treatment at weekly intervals and occasionally treatments were given twice weekly. However, since the treatments were reduced to three hour sessions many patients have been treated twice and three times weekly. These more frequent treatment sessions have proved advan-

tageous particularly since the advent of hospital insurance, because the patient may be admitted for a period of thirty days and receive a full course of treatment in this interval. It is worthy of note that no difficulties have arisen from administering treatment this frequently in spite of the fact that the arsenical medication is given with each treatment session and the bismuth preparation given on the average of twice weekly. However, for the patient who is unable to give up his work entirely for a period of weeks, there has been a certain practical advantage in administering treatment at weekly intervals, which allows the patient to continue with his work while being treated. Individualization of the treatment program according to the status of the patient under treatment is of paramount importance. Most patients being treated for neurosyphilis can tolerate the three hour sessions without difficulty. However, in markedly debilitated patients, particularly those of the tabetic group and those in the upper age bracket whom we consider poor risks in artificial fever therapy, it has been our practice to administer treatments in shorter sessions and gradually increase the length of the sessions as the patient's tolerance increases. Under these circumstances it is decidedly advantageous to have the patient hospitalized so that a complete medical program can be carried out in connection with the specific treatment. With the improvement in the apparatus this individualization has been further developed. At the present time it is rare that a patient who wishes to receive treatment for neurosyphilis cannot tolerate enough artificial fever to benefit him if he has an active process.

Since 1931 we have subjected 1,376 patients to artificial fever therapy. Complications from this method of treatment have greatly lessened as the apparatus and the technic of administration have improved. The strict adherance to a program of discontinuing treatment in the event the patient has an untoward reaction has thwarted many disasters which probably would have occurred if treatment had been continued.

The constant control of the patient's temperature by the nurse-technician facilitates not only the ease of administration of this method of treatment but gives additional opportunity for immediate discontinuance of the treatment whenever the need arises. The use of the indicating thermometer, which gives the nurse-technician an accurate check of the patient's temperature at all times, allows further advantage in preventing untoward reactions that could occur as the result of sudden rises in the temperature.

Only those patients who have been under observation for periods of time from eighteen months to ten years and four months are considered in this report. Of the 271 patients treated by us for neurosyphilis, the records of 64 (or 23.5 per cent) were excluded from consideration because of incomplete post-therapy observation. Thus the records of 208 patients fulful the necessarily rigid criteria for critical analysis. The results of the treatment of these patients are shown statistically in the accompanying table.

Dementia Paralytica

The 93 patients treated for dementia paralytica were grouped according to the classification adopted by the Committee on Non-Specific Therapy of Syphilis of the United States Public Health Service as having "mild," "intermediate" or "severe" dementia paralytica. Similarly, in the appraisal of the results of therapy, the criteria adopted by this committee were employed. The average age of patients treated for dementia paralytica was 37.9 years. All but 23 of the 93 patients had received presumably adequate chemotherapy prior to the institution of artificial fever therapy; the others had received insignificant amounts of chemotherapy or none.

TABLE I. — *Data on Patients Treated With Combined Artificial Fever Therapy and Chemotherapy.*

Type of Neurosyphilis	Number Treated	Incomplete Follow-up Data	Included for Analysis	Remission	Improvement	No Improvement	Progression	Reaction of Blood: Became Negative	Reaction of Blood: Less Positive	Reaction of Blood: Unchanged	Reaction of Spinal Fluid: Became Negative	Reaction of Spinal Fluid: Less Positive	Reaction of Spinal Fluid: Unchanged
Dementia paralytica, mild	48	9	39	23	14	2	0	18	19	2	16	16	7
Dementia paralytica, intermediate	47	9	38	21	9	5	3	8	29	1	6	26	6
Dementia paralytica, severe	19	3	16	2	8	3	3	4	7	5	3	7	6
Tabetic form of dementia paralytica	37	6	31	18	6	5	2	12	12	7	11	12	8
Tabes dorsalis, mild	8	2	6	4	2	....	....	5	1	....	3	1	2
Tabes dorsalis, intermediate	30	13	17	9	5	3	....	8	5	4	8	3	6
Tabes dorsalis, severe	22	12	10	2	5	1	2	5	3	2	6	2	2
Meningeal neurosyphilis	9	1	8	7	1	....	....	5	2	1	6	2	....
Vascular neurosyphilis	13	1	12	4	1	4	3	3	8	1	3	6	3
Meningovascular neurosyphilis	12	3	9	8	....	1	....	4	4	1	5	4	....
Asymptomatic neurosyphilis	26	4	22	....	....	....	....	12	9	1	11	9	2
Totals	271	63	208	98	51	24	13	84	99	25	78	88	42

Included for analysis were the clinical and serologic data on 39 patients with mild dementia paralytica. Further proof of the necessity for treating patients with dementia paralytica during this early stage of the disease is found in the fact that 23 of the 39 patients (59 per cent) achieved remission and 14 (35 per cent) were improved. Thus 94 per cent were benefited while 2 patients were not improved. In those treated for "mild" paresis, the blood serologic reactions were reversed to negative in 18 patients (or 46 per cent), became less positive* in 19 additional patients (or 49 per cent), and were not influenced in 2 patients (or 5 per cent). The spinal fluid serologic reactions became negative in 16 patients (or 41 per cent), were less positive at the time of last observation in 16 patients (or 41 per cent), and remained positive in 7 patients or 18 per cent).

Of the 38 patients with "intermediate" dementia paralytica, 21 (or 55 per cent) obtained remission, 9 patients (or 24 per cent) were improved. Thus, 57 per cent of those with "intermediate" paresis were benefited. Five patients in this group were not improved, and the disease progressed following treatment in 3 additional patients. The blood serologic reactions were reversed to negative in 8 patients (or 21 per cent) of those with "intermediate" paresis, because less positive in 29 patients (or 76 per cent), and remained positive in one patient (or 3 per cent). The spinal fluid serologic reactions were changed in 6 patients (or 16 per cent) to negative, were less positive at the time of the last examination in 26 patients (or 68 per cent), and remained positive in 6 patients (or 16 per cent).

As would be anticipated, the proportion of favorable clinical responses to the combined method of fever-chemotherapy was distinctly less among the patients with severe dementia paralytica. In this advanced stage of the

* In this evaluation "less positive" reactions were determined by Quantitative Kahn Titers.

disease, only 2 (or 13 per cent) achieved clinical remission. Eight additional patients (or 50 per cent) were improved. In 3 patients there was no improvement, while in 3 others the disease progressed despite treatment. It is perhaps of importance to indicate, however, that even among these patients a certain amount of salvage was effected. Over one-half were benefited. The responses of the blood and spinal fluid reactions exhibited no constant relationship to the clinical outcome. The reactions remained strongly positive in some patients who achieved clinical remission and were negative in some in whom the disease process was either uninfluenced or progressed. The serologic reactions of the blood became negative in 4 patients (or 25 per cent), became less positive in 7 patients (or 44 per cent), and remained positive in 5 (or 31 per cent). The spinal fluid reactions were reversed to negative in 3 patients (18 per cent), became less positive in 7 patients (or 44 per cent), and were still positive at the time of the last observation in 6 patients (or 38 per cent).

Tabetic Form of Dementia Paralytica

In the group of 31 patients with the tabetic form of dementia paralytica the symptoms and signs of dementia paralytica usually dominated the clinical picture. All but 1 had received varying amounts of chemotherapy prior to artificial fever therapy. While many of these patients achieved coincidental improvement in both tabetic and paretic manifestations, the clinical outcome of therapy was largely dependent on the relative mildness or severity of the paretic symptoms. Since it was not considered feasible to classify such patients in "mild," intermediate" or "severe" categories because of the great variation in the relative degrees of paretic and of tabetic symptoms, they are considered as one group. Those with lightning pains, gastric crises "cord bladder" or ataxia of the lower extremities of less than two years' duration responded favorably to treatment. Those patients in whom these symptoms had existed for more than two years showed little sustained improvement regardless of the amount of treatment given.

Eighteen of the 31 taboparetic patients or (58 per cent) achieved clinical remission of both tabetic and paretic symptoms. Six additional patients (or 19 per cent) were improved. Thus, 24 of the 31 patients (or 77 per cent) in this group responded favorably. Five patients with severe paretic symptoms were not improved and the disease progressed during and after treatment in two demented patients who died six months and one year, respectively, after the course of treatment was completed.

The blood serologic reactions were reversed to negative in 12 patients (or 39 per cent), became less positive in 12 patients (or 39 per cent), and remained unchanged in 7 patients (or 22 per cent). The spinal fluid serologic reactions were reversed to negative in 11 patients (or 35 per cent), became less positive in 12 patients (or 39 per cent), and were not influenced in 8 patients (or 26 per cent).

Tabes Dorsalis

All of the 33 patients with tabes dorsalis had received varying amounts of chemotherapy before artificial fever therapy was begun. Included in this group of patients were 6 with "mild" tabetic manifestations, such as lightning pains of recent origin, paresthesias, pupillary disturbances, reduced or exaggerated reflexes or diplopia. There were 17 patients with "intermediate" tabes dorsalis, in which groups were included those manifesting such signs and symptoms as those mentioned above together with such additional evidences as "cord bladder," early and mild ataxia, gastric crises or early optic nerve atrophy. The 10 patients with "severe" tabes dorsalis exhibited such

manifestations as marked ataxia, severe lightning pains or gastrointestinal crises or both, incoordination, "cord bladder," marked hyperesthesias or paresthesias, optic nerve atrophy or Charcot joints. Most of the patients with severe tabes dorsalis presented evidences of advanced malnutrition and avitaminosis; many verged on starvation because of almost uninterrupted gastrointestinal crises. These patients presented the most trying treatment problems. Most of these would not have been considered as candidates for either malaria therapy or artificial fever therapy a few years ago. With the improvements in the apparatus for the production of fever and in the technic of administering the treatments, a significant proportion of these patients may be benefited. Such patients are first given short trial fever treatments, at a low level, after three or four of which it is usually possible to give the usual three hour sessions at 105 F. (41.1 C.). Correction of dietary deficiencies, of anemia and often of narcotic addiction are essential requirements in the therapeutic program.

Of the 6 patients with mild tabes dorsalis, 2 were improved and 4 obtained lasting remission. The lightning pains often responded after the first two or three treatments. There has been no recurrence of such pains in the patients with mild tabetic symptoms; additional treatments were not required in this group of patients. The blood serologic reactions of the "mild" tabetic patients were reversed to negative in 5 patients (or 83 per cent), and the sixth patient (or 17 per cent) became less positive. The spinal fluid serologic reactions became negative in three patients (or 50 per cent), were less positive at the time of the last examination in 1 patient (or 17 per cent) and remained unchanged in 2 patients (or 33 per cent).

Nine (or 53 per cent) of the 17 patients with intermediate tabes dorsalis obtained clinical remission after one course of combined fever-chemotherapy. Three patients with mild and early ataxia were restored to normal gait. Five (or 29 per cent) of the patients with intermediate tabes dorsalis obtained improvement. Three of these patients experienced recurrence of root pains, which were controlled with additional fever-chemotherapy. Two patients with "cord bladder" regained control of bladder function. Some improvement in gait occurred in all of the patients in this group. Three patients (or 18 per cent) with intermediate tabes dorsalis were not benefited by the course of treatment. The blood serologic reactions were reversed to negative in 8 (or 47 per cent) of the patients with "intermediate" tabes dorsalis, became less positive in 5 patients (or 29 per cent), and were uninfluenced in 4 patients (or 24 per cent). The spinal fluid serologic reactions were reversed to negative in 8 patients (or 47 per cent), became less positive in 3 patients (or 18 per cent) and were unchanged in 6 patients (or 35 per cent).

The results of treatment were decidedly inferior in the group of 10 patients with severe tabes dorsalis. Remission occurred in only 2 patients (or 20 per cent). Some measure of improvement, including relief of pain or improvement in bladder function, occurred in 5 patients (or 50 per cent). In 1 patient there was no improvement. In 2 patients with advanced tabes dorsalis the disease progressed despite treatment, and these patients died of the disease several months after the completion of the course of treatment. The blood serologic reactions became negative in 5 patients (or 50 per cent), became less positive in 3 patients (or 30 per cent), and were unchanged in 2 patients (or 20 per cent). The spinal fluid serologic reactions were reversed to negative in 6 patients (or 60 per cent), were less positive at the time of the last examination in 2 patients (or 20 per cent) and remained unchanged in 2 patients (or 20 per cent).

Meningeal Neurosyphilis

Eight patients with meningeal neurosyphilis were treated with combined artificial fever therapy and chemotherapy. All but 1 had had presumably adequate chemotherapy. The characteristic manifestations of syphilitic meningitis were present, such as headache, dizziness, diplopia, nausea, vomiting, nuchal rigidity, aphasia or convulsions associated with the typical spinal fluid changes (pleocytosis, increased protein content and strongly positive serologic reactions). Seven of the 8 patients (or 87 per cent) experienced complete clinical recovery; the eighth patient was relieved of all symptoms and signs except residual diplopia. The spinal fluid cell count was promptly reduced in all to normal; the protein content of the spinal fluid exhibited a similar but invariably slower reduction to normal levels. The blood serologic reactions were reversed to negative in 5 patients (or 62 per cent), became less positive in 2 patients and remained positive in another. The spinal fluid serologic reactions were favorably influenced in all; there was reversal to negative in 6 (or 75 per cent), and less positive in 2 (or 25 per cent).

Vascular Neurosyphilis

Thirteen patients received combined artificial fever and chemotherapy because of vascular neurosyphilis. The records of 12 patients are complete to date; the thirteenth patient disappeared shortly after having attained an apparently favorable response to treatment. Of the 12 patients whose records are included in this analysis, all but 1 had received presumably adequate, but ineffectual, chemotherapy prior to the institution of artificial fever therapy.

The patients classified as having vascular neurosyphilis did not present evidence of meningeal involvement, but presented such subjective and objective manifestations of vascular neurosyphilis as headaches, dizziness, monoplegia, hemiplegia, aphasia, recurrent cerebrovascular accidents in the absence of evident arteriosclerosis or convulsions, together with characteristic spinal fluid changes.

Of the 4 patients (or 33 per cent) who achieved complete remission, 2 had experienced cerebrovascular accidents followed by transient hemiplegia; there has been no recurrence in either patient during the three and five years intervals which have elapsed since fever-chemotherapy was given. One patient was improved, but some residual hemiplegia has persisted. Four patients (or 33 per cent) were not improved, while in 3 others (or 25 per cent) the disease progressed. One in this group died four months after finishing his last course of treatment. It is interesting to note that this patient was treated over a period of over two years and had received three courses of treatment. After each course marked improvement was noted, but his clinical status did not remain improved. Between the first and the second course of treatment he returned to his former occupation, but after the second course his disease progressed slowly, and after the third course of treatment no improvement was noted. The blood serology reactions were reversed to negative in 3 patients (or 25 per cent), became less positive in 8 patients (or 67 per cent) and remained positive in one patient. The spinal fluid serologic reactions became negative in 3 patients (or 25 per cent), were less positive at the time of the last examination in 6 patients (or 50 per cent), and have remained positive.

Meningovascular Neurosyphilis

The 9 patients with meningovascular neurosyphilis whose records are complete exhibited various combinations of meningeal and cerebrovascular

manifestations. In some the vascular component was predominant, while in others the meningeal involvement was more pronounced. The meningitis phenomena were promptly and favorably influenced in all. Eight of the 9 patients (or 89 per cent), achieved complete remission; the other patient experienced no improvement in the hemiparesis which had developed 3 months before artificial fever treatment was begun. The blood serologic reactions were reversed to negative in 4 patients (or 44 per cent), became less positive in 4 patients (or 44 per cent), and were unchanged at the time of the last examination in one patient. The spinal fluid serologic reactions became negative in 5 patients (or 56 per cent), and became less positive in 4 patients (or 44 per cent).

Asymptomatic Neurosyphilis

It is now generally recognized that the best time to treat neurosyphilis with fever-chemotherapy is when the disease is first recognized in its asymptomatic phase. The more common and eminently desirable practice of performing spinal fluid examinations before, during and after the course of antisyphilitic chemotherapy, has provided indisputable evidence of the high incidence of neurosyphilis. The extensive and carefully documented cooperative clinical studies made by Stokes and associates,[11] revealed that abnormal spinal fluid conditions were present in 33 per cent of patients with early syphilis and in 56.1 per cent of patients with late secondary syphilis. The same observers have also stated that "even thorough going [chemical] treatment does not necessarily prevent the development of abnormalities of the spinal fluid" and that in latent syphilis "almost all the serologic response to be expected occurs within the first four months of treatment; thereafter, further [chemical] treatment has little effect." In our experience, the favorable response to combined artificial fever-chemotherapy has been most prompt in those patients who were referred to us for such treatment immediately after the diagnosis of asymptomatic neurosyphilis was first established. All but 5 of our patients with asymptomatic neurosyphilis had had presumably adequate chemotherapy.

Of the 22 patients with asymptomatic neurosyphilis treated by us with artificial fever-chemotherapy who have been observed at intervals for a sufficiently long period, the spinal fluid serologic reactions, cell count and protein content have been restored to normal in 11 (or 50 per cent). The serologic reactions of the spinal fluid showed a declining trend at the time of the last observation in 9 additional patients (or 41 per cent). Thus there was improvement in the serologic status of 20 (or 91 per cent) of these patients. In the remaining 2 patients (or 9 per cent), the spinal fluid reactions were still positive at intervals of four and five years, respectively. On the basis of prior experience, there is reason to anticipate that those patients who now exhibit a declining trend in serologic positivity and that those more recently treated patients whose reactions are still positive will ultimately obtain a successful result. No patient who achieved serelogic reversal has experienced either serologic relapse or any evidence of sypmtomatic neurosyphilis. The responses in the blood serologic reactions closely paralleled those in the spinal fluid. Twelve of the patients (or 55 per cent), achieved negativity. Nine additional patients (or 41 per cent), exhibited less positive reactions, while one more recently treated patient had unchanged positive reactions at the time of the last observation.

It seems axiomatic to state, therefore, that the best treatment for neurosyphilis is to detect it in its incipiency and to prevent the later develop-

ment of its disastrous consequences by the prompt administration of some form of fever therapy combined with chemotherapy.

In summary, it is interesting to note that the remission rate for all the 208 well documented cases of various types of neurosyphilis was 52 per cent. An additional 28 per cent of the patients were improved by the treatment. Thus, a total of 80 per cent of the patients were benefited.

Summary and Conclusions

1. After a decade of rich and constantly enlarging experience with physically induced artificial fever therapy, the successful results achieved by many workers in many lands are sufficiently comparable to justify the categorical statement that artificial fever therapy is at least as effective as malaria therapy in the management of symptomatic or asymptomatic neurosyphilis. In the hands of many reliable investigators artificial fever therapy has yielded significantly superior results. Patients who have not responded well to malaria therapy have been benefited by subsequent artificial fever therapy.

2. There is unmistakable evidence that the extent of clinical improvement in neurosyphilitic patients is related directly to the height and the duration of fever. The thoroughly documented analyses made by statisticians of the United States Public Health Service provide proof that the clinical responses were directly inferior when relatively low temperature levels were employed. There is no longer any valid reason to assume that Plasmodium malaria exerts any specific effect on Spirochaeta pallida.

3. Several investigators who have had long experience with malaria therapy and with artificial fever therapy have abandoned malaria therapy in favor of artificial fever therapy. This decision was determined largely by the observations that patients tolerate artificial fever therapy more readily, that a high proportion of neurosyphilitic patients can be treated with artificial fever on an ambulatory basis without interruption of gainful employment and that treatment complications are minimized with artificial fever therapy.

4. Since continuous hospitalization is not a requirement for the artificial fever treatment of most neurosyphilitic patients, the cost of the treatment is not necessarily greater than with malaria therapy. If the patient remains at his regular employment during the course of artificial fever treatments, the cost is usually much less.

5. The employment of auxiliary chemotherapy in conjunction with any type of fever therapy is an essential requirement. There is evidence that the concurrent use of chemotherapy with artificial fever therapy increases the therapeutic effectiveness of both agencies.

6. The hazards inherent in the various physical modalities used for the production of artificial fever during the first few years of the undertaking have been largely eliminated. Recognition of the physiologic changes produced by fever has led to the utilization of means to combat such effects. A procedure which was looked upon as a technical feat a decade ago may now be applied by skilled workers with a frequency which approaches routine.

7. Developments of the past few years have demonstrated that equally favorable clinical and serologic results may be obtained with fewer total hours of artificial fever therapy, applied in shorter individual sessions at more frequent intervals. This practice permits the treatment of more patients at less cost.

8. The excellent results following the use of combined fever-chemotherapy in cases of neurosyphilis indicate that the patient's best interests are served by the prompt administration of this form of treatment.

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THE RATIONALE OF OXYGEN THERAPY DURING FEVER THERAPY *

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The physiologic paradox of oxygen want in the presence of normal arterial oxygen saturation, adequate oxygen capacity, and a competent circulation is a phenomenon usually associated with the interference by drugs with either the ability of the hemoglobin to transport oxygen or the ability of the tissue to utilize the oxygen. Evidence will be presented to support the contention that a similar paradox exists as the result of induced hyperpyrexia.

In a limited number of clinics, the use of oxygen therapy during the period of induced fever has been instituted on the basis that the increase in metabolism coincident with the increase in body temperature requires a greater amount of oxygen than can be acquired from the respiration of air. In view of the fact that there is a 5½ to 7½ per cent increase in metabolism for every degree (Fahrenheit) of elevation in temperature,[1] it has seemed logical to provide these individuals with oxygen in excess of that present in the atmosphere. Once instituted as a clinical practice, the beneficial clinical response obtained from the administration of oxygen therapy has resulted in its continued use.

Figure 1 is a graph representing the pulse rates of three unselected groups of individuals receiving artificial fever by means of the Burdick cabinet. The degree of fever and the length of treatment are the same in all three groups. One group of 45 patients was not given oxygen therapy during the treatment, another group of 25 patients received oxygen therapy only after the desired level of fever had been established, and the remaining group of 45 patients received oxygen therapy with or shortly after initiation of the fever therapy.

A striking difference is apparent in the pulse rates of the three groups. In the group receiving no oxygen therapy, the pulse rate climbed rapidly to a high level and continued to increase as the treatment progressed. In the group given oxygen therapy after the desired level of fever had been reached, the pulse rate climbed rapidly to the same level as in the first group but slowed after the oxygen was administered, and remained at the lower level during the course of the treatment. In the group given prophylactic oxygen therapy with or shortly after the initiation of fever, the pulse rate became elevated, but never reached the high level of the two previous groups, and it persisted at this relatively low level during the hyperthermia.

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It was also observed that restlessness, mental confusion, and excitement were less frequent and less marked in the patients receiving oxygen therapy. Sedation by drugs was required less frequently and in smaller dosages. In the absence of oxygen therapy, treatment had to be discontinued in some patients because of either extreme tachycardia of poor quality or uncontrollable excitement. These same patients tolerated the treatments satisfactorily when oxygen therapy was administered.

The clinical findings just presented represent significant clinical evidence of oxygen want during fever therapy. Laboratory evidence of the mechanism of this oxygen want and the manner in which oxygen therapy tends to correct the deranged physiology is now presented.

The 13 patients used in the laboratory investigation were, for the most part, receiving treatment for syphilis of the central nervous system or in-

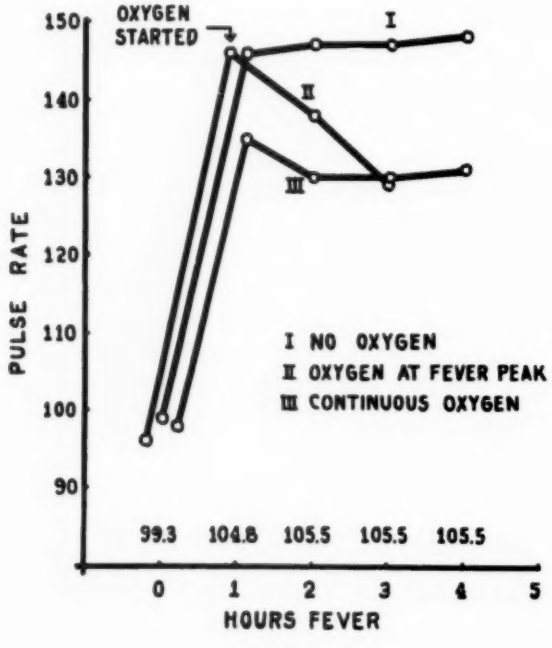

Fig. 1

fectious arthritis. As far as could be determined, the patients possessed normal circulatory and respiratory mechanisms, were not receiving drug therapy, and had a normal hemoglobin and red cell count. There were no fluid restrictions before or during therapy, nor were excesses of fluid administered before or during therapy. The average level of fever was 105 F. and the average length of treatment four hours. The hyperthermia was accomplished by the use of the Burdick cabinet. Oxygen, when given, was administered by the oropharygeal catheter method at a flow rate of 6-8 liters per minute. Twenty experimental studies were conducted on these patients. In 5 of these, the patients received no oxygen therapy during the treatment. In 7, oxygen therapy was given after the desired level of fever had been reached. In 5 others, oxygen therapy was given with or shortly after the initiation of fever. In the remaining 3, approximately 5

per cent carbon dioxide in air was administered after the desired level of fever had been reached.

Arterial and venous blood samples were drawn at three points in the procedure according to the method described by Adriani.[2] The first pair was drawn before the fever was induced. The second pair was drawn when the desired level of fever was reached. The third pair was drawn approximately an hour after the second pair. The time between the first and second pair varied with the speed of induction of the fever, being on the average one and three-quarters hours. The blood was taken from the ulnar or radial artery for the arterial samples, and from the median vein in the antecubital space for the venous samples. No tourniquet was used during the drawing of blood. The samples remained in the syringes which were kept on ice until the determinations were made. These determinations were made according to the method of Van Slyke and Neil[3] in the Van Slyke mano-

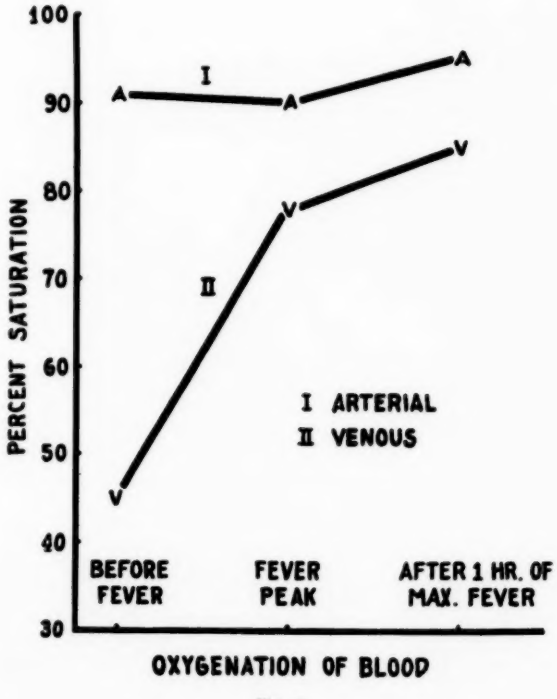

Fig. 2

metric apparatus. On each sample of blood, oxygen and carbon dioxide contents were determined and on one of each pair of samples, an oxygen capacity was run. pH determinations were made on each sample by means of the Beckman glass electrode potentiometer. With these data, the percentage of oxygen saturation of each sample was computed. The tension in mm. Hg of carbon dioxide in each sample was calculated from line charts devised by Van Slyke and Sendroy,[4] since the pH and the carbon dioxide contents of whole blood were known. The tension in mm. Hg of oxygen in each sample was then calculated from the ordinary dissociation curves of hemoglobin, since the carbon dioxide tension and the percentage of saturation were known.

At the start of the investigation it was expected that, because of the increased demand for oxygen as a consequence of the elevated metabolic level, there would be an increased arterio-venous difference in oxygen saturation. Some investigators have reported increased desaturation of the venous blood returning from the brain in the presence of fever.[5] As can be seen, however, from the graph in figure 2, there was a marked decrease in the arterio-venous difference in the vessels selected for sampling even in the absence of oxygen therapy, as represented by the readings at the peak of fever. This is easily explained on the basis of acute and marked dilation of the arterioles and capillaries of the extremity due to the heat of the cabinet.[6]

In the absence of oxygen therapy the percentage of saturation decreased slightly, but the oxygen capacity increased, indicating no reduction in the supply of oxygen in the blood stream. The increase in saturation with the administration of oxygen therapy, as represented by the last readings on the graph, was significant, but slight, and seemed not enough to account

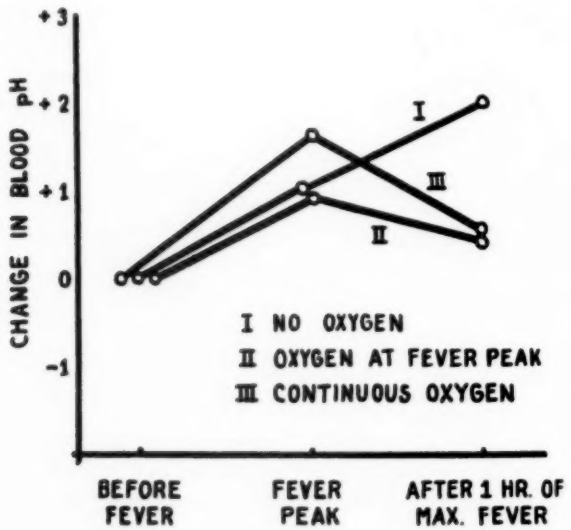

Fig. 3

for the clinical benefit previously indicated. In fact, this information seemed to contradict the clinical evidence of need for oxygen. It was apparent then that there was interference with either the ability of the hemoglobin to make this oxygen available to the tissue, or there was interference with the tissues' ability to utilize the oxygen.

Numerous investigators have reported an increase in pH associated with artificial fever therapy and the presence of an uncompensated alkalosis.[7] The graph in figure 3, representing the changes in pH of arterial blood during the course of treatment, indicates that this is also true of the patients used in this study. The elevation in pH occurs in all four groups. When no oxygen is given the pH continues to rise, whereas there is a tendency toward restoration of pre-fever values in those individuals given oxygen or carbon dioxide in air during the treatment.

The rise in pH is probably chiefly due to the loss of carbon dioxide through the hyperventilation accompanying the fever.[7a] The patients in this study had an average drop of 15 per cent in the carbon dioxide content of

their blood, and, as can be seen in figure 4, they have reduced carbon dioxide tensions. This reduction in carbon dioxide tension progresses in those individuals receiving no oxygen therapy during treatment. In the group given oxygen or carbon dioxide, the opposite is true.

It has been suggested[8] that alkalosis may so interfere with the liberation of oxygen by hemoglobin that insufficient oxygen is released to supply the needs of the tissues. The fundamental factor in the supply of oxygen to the tissues is the difference in tension between arterial blood and tissue. Any interference with the maintenance of a normal oxygen tension will seriously reduce the amount of oxygen available to the tissue. The data obtained in this study show that the alkalosis present during fever effects a significant reduction in the arterial oxygen tension even in the presence of a normal arterial oxygen saturation.

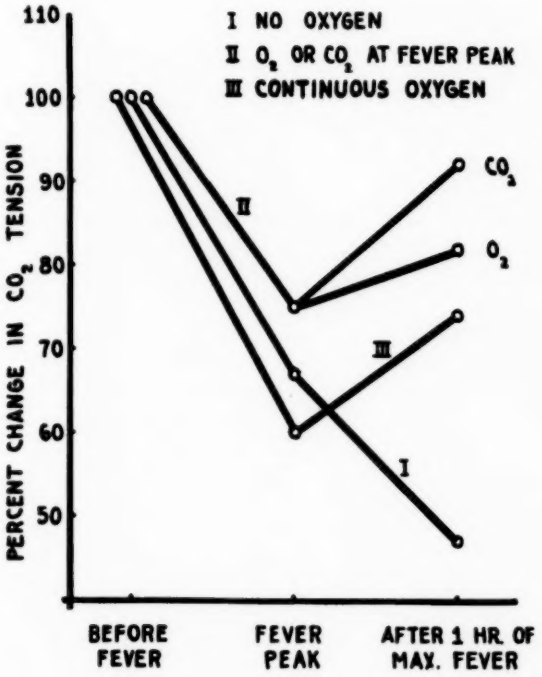

Fig. 4

The graph in figure 5 represents percentage changes in the tension of oxygen in the arterial blood of the four groups. In the group receiving no oxygen therapy treatment, the arterial tension falls as much as 25 per cent with the development of the desired level of fever, and continues to fall as the treatment progresses. In the group receiving oxygen therapy after the desired level of fever had been reached, the arterial tension first falls 18 per cent, but with the administration of oxygen, it rises to a point 19 per cent above the original level. In the group receiving oxygen during the whole treatment, there is no drop in tension, but rather a continuous rise. In the group given approximately 5 per cent of carbon dioxide in air after the desired level of fever had been reached, the clinical responses obtained were apparently equally as beneficial as those obtained with oxygen. Although the oxygen tension returned to above the pre-fever level, the increase above that level was not as great as with the administration of oxygen. The

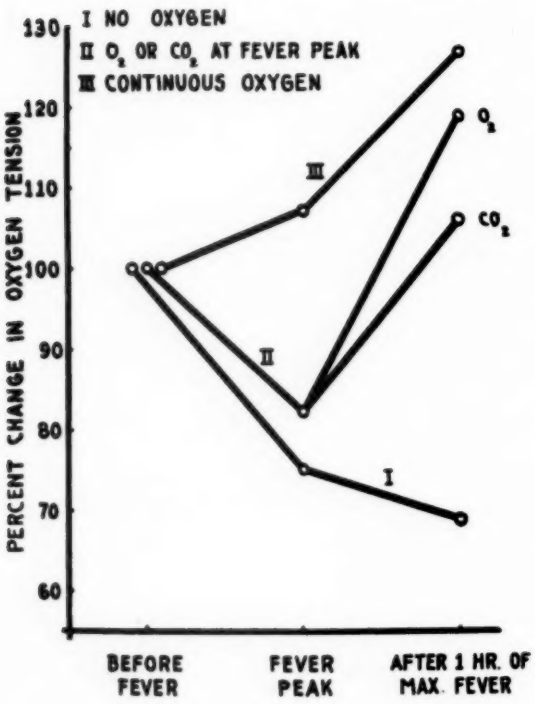

Fig. 5

drop in tension observed in the groups receiving no oxygen until the peak of fever is comparable to that obtained by ascending to an elevation of 17,500 feet.

Discussion

The fall in arterial oxygen tension provides a reasonable explanation for the clinical evidence of oxygen want. The interference with the supply of oxygen to the tissues is probably due to the decreased rate of diffusion of oxygen accompanying the fall in arterial tension. Two factors, at least, operate to emphasize the deficiency in oxygenation of the tissue: one, the decreased rate of diffusion, and two, the increased demand for oxygen by the tissue because of the elevated metabolic level.

The administration of oxygen benefits the patient chiefly by physical methods. That is, an increase in the alveolar concentration increases the partial pressure, thereby increasing the saturation of the blood with a consequent increase in tension in spite of the elevated pH. The break in the vicious cycle of low tension, high pH, and tissue hypoxia may also be effected by the increased amount of oxygen in physical solution in the plasma, which oxygen is readily available to the tissue and not dependent on dissociation of hemoglobin.

Although carbon dioxide seemed equally effective in controlling the oxygen want in this type of case, oxygen is the method of choice. One cannot clinically estimate the concentration of carbon dioxide required. Too little carbon dioxide, to be effective, may then be given, but more hazardous would be the administration of too high a concentartion with consequent narcotic or convulsant manifestations of toxic concentrations reaching hypoxic tissue. It may also be necessary to carry a higher than normal oxygen tension in the presence of the accelerated metabolic state. For this reason and the fact

that excesses of oxygen can do no harm, oxygen is preferred to carbon dioxide as therapy.

Summary

In the presence of hyperpyrexia there is a reduction in arterial oxygen tension. The administration of oxygen therapy prevents this reduction and may explain the clinical evidence of benefit from oxygen therapy.

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ULTRAVIOLET BLOOD IRRADIATION THERAPY

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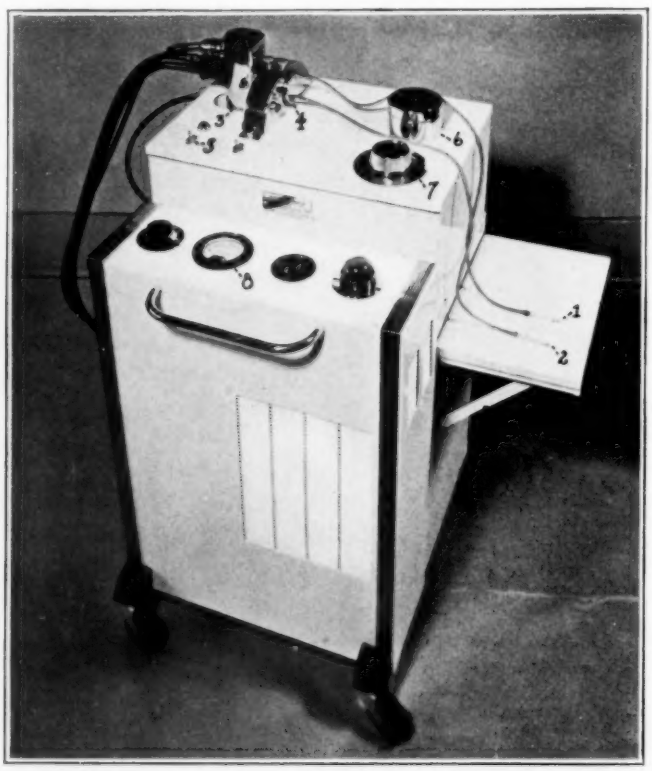
By ultraviolet blood irradiation therapy, or blood irradiation, is meant today the technic originally devised and recently modified by E. K. Knott, of Seattle, of withdrawing and citrating a predetermined amount of a patient's venous blood and immediately returning the citrated blood intravenously through a Knott hemo-irradiator shown in the accompanying photograph, a machine which is designed to receive the citrated blood, expose it to ultraviolet radiation from a mercury-quartz burner and return it intravenously.

I shall endeavor in this paper to present briefly what work has been done in this field to date by outlining the history of its development, the technic and the dosage employed, the known biochemical and physiologic effects of ultra-



Blood irradiation machine (Knott hemo-irradiator). *1*, glass-tipped adapter for the suction, or withdrawal, end of the rubber tubing system. *2*, glass-tipped adapter for the intravenous, or injection, end of the system. This is fitted to a needle in the patient's vein. Citrated blood that has just passed through the irradiation chamber (see *4*) and thus been irradiated is returned to the venous circulation through this adapter. *3*, water-cooled, mercury-quartz burner, the source of high-intensity ultraviolet energy used in irradiating blood. *4*, Knott irradiation chamber with quartz window held in contact with mercury-quartz burner. Blood is passed through this chamber, its time of exposure being carefully and automatically adjusted. *5*, hemo-irradiator starting switch. *6*, synchronized transfusion pump. *7*, dial regulating rate of flow and time of exposure. *8*, voltmeter.

violet rays observed to occur after blood irradiation, the present field of clinical application, its future potentialities and its suggested application to war medicine.

History

In 1934 Knott and Hancock[1] reported the rather spectacular recovery of 2 apparently moribund patients—1 with septicemia and 1 with brain abscess—after the ultraviolet irradiation of a predetermined amount of their blood and immediate reinjection of that blood. The technic has since been somewhat modified by Knott and in its modified form is that referred to in this paper as the Knott technic of ultraviolet blood irradiation therapy.

Since 1939 a series of reports has been made respectively by Rebbeck[2] Barrett[3] and Miley,[4] each working independently, on the results of further investigations of several phases of its clinical application. These reports demonstrated clearly the occurrence after use of this method of several of the known biochemical and physiologic effects of ultraviolet energy, such as the bactericidal and the detoxification effects. The combined total of blood irradiations done by Rebbeck, Barrett and Miley had reached 6,520 by June 1, 1942;[5] the complete absence of deleterious effects has been observed by all physicians with the method.

Technic and Dosage

The irradiation of blood with ultraviolet energy by means of a hemo-irradiator is made possible by a combination of three devices: (1) a modified Knott irradiation chamber, (2) an automatic transfusion pump and (3) a water-cooled, mercury-quartz burner.

The irradiation chamber is a silver, disk-shaped, quartz-windowed container through which the blood passes and in which it is irradiated.

The automatic transfusion pump allows blood to be pumped by propulsion through rubber tubing and through the Knott chamber at whatever rate is desired, thus making possible careful control of the time of exposure to ultraviolet energy of each cubic centimeter of blood as it passes through the chamber. An intermittent exposure is obtained by a rotating shutter interposed between the irradiation chamber and the mercury burner.

The water-cooled type of mercury-quartz burner is used and is fastened approximately 1 cm. from the quartz window of the irradiation chamber through which the blood is pumped. The ultraviolet rays are confined to a closed, highly polished steel housing and have the same intensity as if at actual contact.

The clinical application of this combination consists of withdrawing a predetermined amount of venous blood from the patient, citrating it (1 part of 2.5 per cent sodium citrate solution to 5 parts of blood) and immediately returning it through the hemo-irradiator to the vein from which it was withdrawn. The immediate return to the venous circulation of irradiated blood through a closed system obviates the rapid loss from irradiated blood of ultraviolet energy, which occurs if blood is, for example, spread out in open flat receptacles during irradiation.

In using this method it is necessary to be sure that three important factors are kept constant. These are (1) the amount of blood withdrawn and irradiated, (2) the time of exposure to ultraviolet energy and (3) the intensity and the wavelength of the spectral energy used.

The amount of blood to be used is calculated from the formula $A = KW$, in which A is the amount in cubic centimeters to be withdrawn, K is a constant (1.5 in this work) and W is weight expressed in pounds. The amount of blood used rarely exceeded 300 cc., as can readily be seen from the formula.

The time of exposure is considered to be the time required for the passage of 1 cc. of blood through the Knott irradiation chamber while exposed at con-

tact to the ultraviolet emanation described hereafter; the average time of exposure in this work was ten seconds.

Ultraviolet wavelengths within the range from 2,399 to 3,654 angstrom units were used. The intensities corresponding to the wavelengths used are shown in the following tabulation:

Angstrom Units (Wavelengths)	Milliwatts/cm.² (Intensities)	Angstrom Units (Wavelengths)	Milliwatts/cm.² (Intensities)
2,399	55,000	2,897	96,000
2,483	88,000	2,967	224,000
2,536	273,000	3,022	435,000
2,652	239,000	3,125-32	718,000
2,753	86,000	3,342	73,000
2,804	139,000	3,473	41,000
		3,650-54	1,538,000

It can be observed from this method of estimating the dose and keeping it relatively constant that the fundamental laws underlying the mechanism of photochemical processes have been carefully taken into consideration. The Grotthus-Draper law,[6] known also as the first law of photochemistry, stating that only light which is absorbed can act chemically; the Bunsen-Roscoe[7] law, which states that a photochemical change is proportional to the intensity and the time of illumination; Stokes'[8] law, stating that the wavelengths of secondary, emitted rays are greater than the primary exciting rays; Einstein's[9] photochemical equivalence law, which states that each absorbed quantum should cause one light-absorbing molecule to react chemically, and the production of chain reactions[10] by secondary emanations, must be as applicable to biochemical reactions as to chemical reactions in general.

Observed Biochemical and Physiologic Effects

1. *Bactericidal Effect.* — The bactericidal effect of ultraviolet energy long has been a matter of common knowledge owing to the excellent work of Downes and Blount,[11] Ward,[12] Coblentz,[13] Bayne-Jones,[14] Wyckoff,[15] Bachem and Dushkin,[16] Hodes, Webster and Lavin,[17] and others. In the course of this work ultraviolet energy has been demonstrated to be lethal for the streptococcus, the staphylococcus, the colon bacillus, the tubercle bacillus, the pneumococcus, etc.

The bactericidal effect of ultraviolet irradiation of the blood has been demonstrated independently both by Miley[4d] (in 103 consecutive cases of acute pyogenic infection) and by Rebbeck[2] in 14 serial cases of generalized peritonitis, 19 cases of appendical abscess, 21 cases of puerperal sepsis and 22 cases of postabortional sepsis. Both Miley and Rebbeck have shown that blood irradiation is a safe and efficient method of controlling infection and that it has often succeeded when chemotherapy has failed. A summary of their work shows that they have found that blood irradiation controls acute pyogenic infections with and without septicemia to an extent hitherto unseen. Exceptions have been Staphylococcus aureus septicemia and bacterial endocarditis.

In the accompanying temperature graphs (figures 1, 2, 3 and 4), one can see clearly the effects observed in spontaneously arising septicemias in human beings, which I feel are a more accurate index of the effect of any bactericidal agent than those observed in artificially induced septicemias in small laboratory animals.

2. *Detoxification Effect.* — Many investigators have shown that both direct sunlight and ultraviolet energy from artificial sources have a definite action on certain organic poisons. The greatest amount of work has been done on snake venoms, saponins, toxic plant proteins and bacterial and virus toxins.

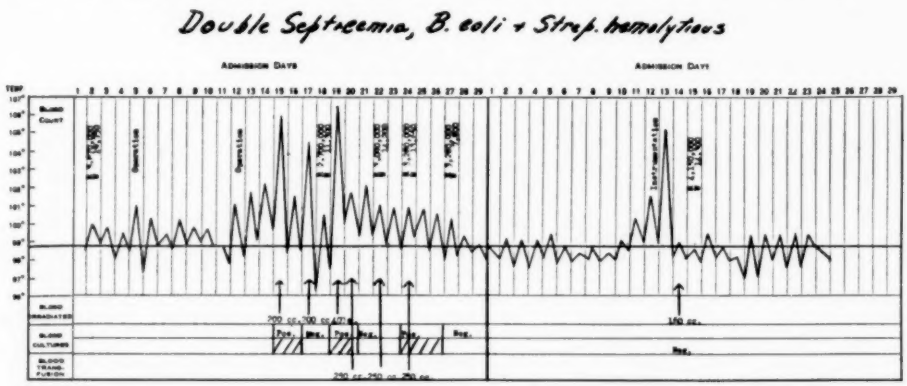


Fig. 1. — This is a rare example of a double septicemia in which blood cultures were found to be positive for both streptococcus hemolyticus and colon bacillus following second stage prostatectomy. It will be observed from the above graph that three blood irradiations were given at forty-eight hour intervals. Forty-eight hours after the first blood irradiation the blood cultures became negative temporarily, and the streptococcus hemolyticus disappeared permanently. However, colon bacillus reappeared in the blood cultures just before the third irradiation, the patient's temperature rising to 106.8 F. at this time. Following the third blood irradiation the patient's clinical condition improved greatly, so no further blood irradiation was given, although the blood cultures became positive with colon bacillus for a three day period seventy-two hours after the third irradiation, but became negative permanently from this period on. The patient continued to convalesce uneventfully, except for an instrumentation chill, and was discharged from the hospital in apparently good condition, and with negative blood cultures thirty-four days after the third irradiation. The fourth blood irradiation was given as a precautionary measure following the appearance of the instrumentation chill. — (Drs. E. W. Rebbeck, R. A. Walther, Shadyside Hospital, Pittsburgh.)

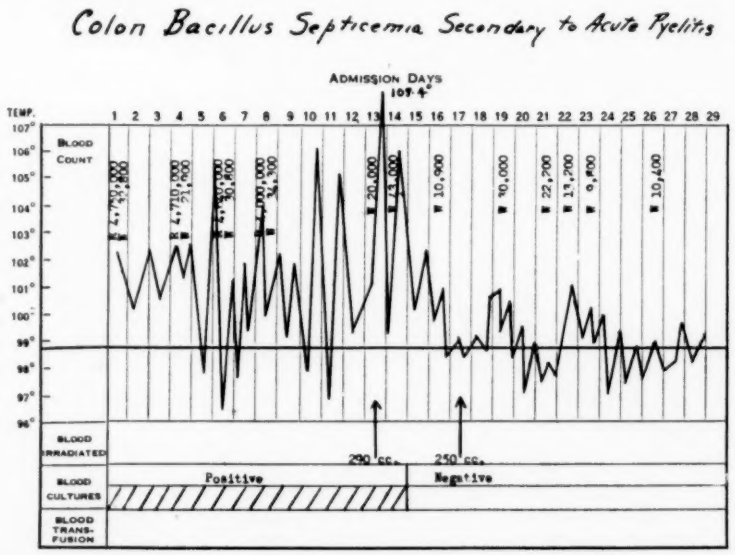


Fig. 2. — In this case of colon bacillus septicemia secondary to acute pyelitis blood irradiation was instituted after the patient had been in a coma for forty hours, her blood cultures had been positive for thirteen days, and her temperature had reached 108.4 F. forty-eight hours after initial blood irradiation blood cultures became negative, and the patient's toxic symptoms began to subside, and ninety-six hours later the patient was greatly improved, temperature falling to normal. A second blood irradiation was given as a precautionary measure. The patient convalesced quite well, leaving the hospital in apparently excellent condition fifteen days after the initial blood irradiation. — (Drs. R. Paine, U. Coe, Portland Sanitarium, Portland, Oregon.)

Noguchi[18] found an inactivation of all the principal toxic effects of the venoms of the cobra (Naja naia), the daboia (Vipera russellii) and the rattle-

snake (Croalus admanteus). Massol[19] and Much, Peemöller and Haim[20] demonstrated conclusively the destruction of cobra venom in vivo. Arthus and Collins[21] showed a marked destruction of the in vivo toxicity of the daboia and the cobra, the fer-de-lance (Bothrops atrox) and the tropical rattlesnake (Crotalus terrificus).

In 1907 Dreyer and Hanssen[22] showed that the glucosides saponin and cyclamin and the toxic proteins ricin and abrin all lose their hemolytic power

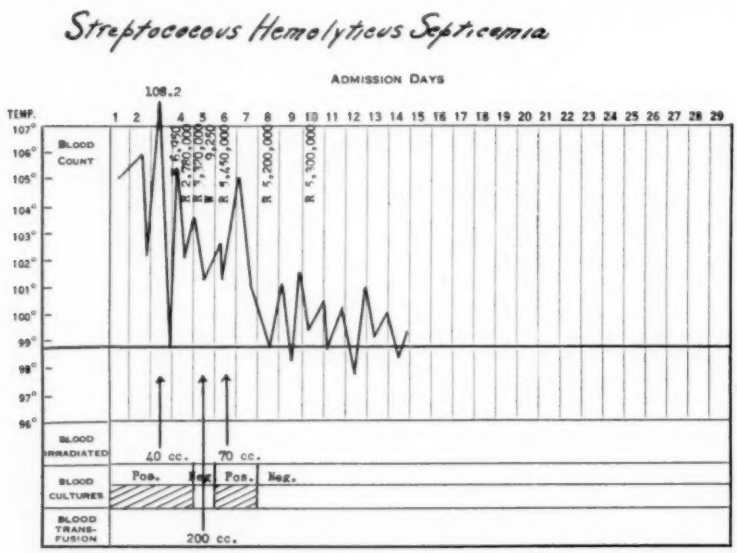


Fig. 3. — Blood irradiation was instituted in this case of streptococcus hemolyticus septicemia secondary to acute otitis media after patient had been in a coma over forty hours, and her temperature had reached 108.2 F. Forty-eight hours after initial blood irradiation a single blood culture came negative, but seventy-two hours later blood culture was positive, and patient's condition became somewhat worse; second blood irradiation was given, within forty-eight hours blood cultures were negative, and the patient began an uneventful convalesence. — (Dr. Hager, Bellevue Hospital, New York.)

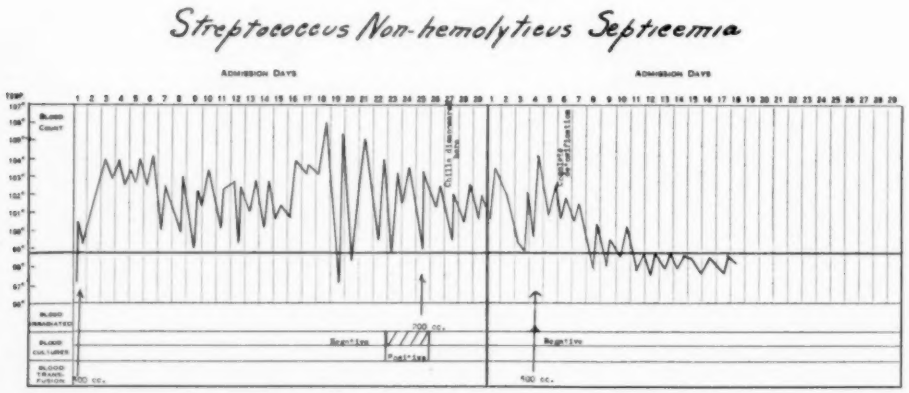


Fig. 4. — At the time of initial blood irradiation this patient had, after twenty-two days of intensive chemotherapy, developed a nonhemolytic streptococcus septicemia secondary to puerperal sepsis following Caesarean section. Twenty-four hours later blood cultures became negative, and forty-eight hours later the patient was free of chills, the first time in twenty-six days. A second blood irradiation was given eight days later. From that point on the patient convalesced uneventfully. — (Drs. H. Crowther, N. Paxson, Hahnemann Hospital, Philadelphia.)

under ultraviolet irradiation. Tappeiner and Jodlbauer,[23] Busck,[24] Baroni and Jonesco-Mihaiesti,[25] Schubert[26] and Carmichael[27] showed that ricin loses its toxicity after ultraviolet irradiation. Welch[28] showed that ricin's toxic and agglu-

tinating powers are destroyed at about the same rate by ultraviolet irradiation but that its antigenic power is more resistant.

As might be expected, many bacterial toxins have been found extremely sensitive to and easily inactivated by ultraviolet rays. In 1889 Roux and Yersin[29] made the observation that diphtheria toxin kept in the dark, was almost completely inactivated by exposure to direct sunlight. This was confirmed by Emmerling.[30] The destruction of tetanus toxin by ultraviolet irradiation was shown by Hartoch, Schurmann and Stiner,[31] as well as by Welch[28] and others.[25]

Tetanus toxin was early found to be sensitive to light by Tizzoni and Cattani,[32] in 1891. Flexner and Noguchi[33] in 1906 noted that photodynamic destruction of the lytic and tetanus spasmic principles of tetanus toxin was more rapid by sunlight in solutions containing eosin or similar dyes. Ultraviolet inactivation of tetanolysin was first described by Courmont and Nogier[34] in 1909.

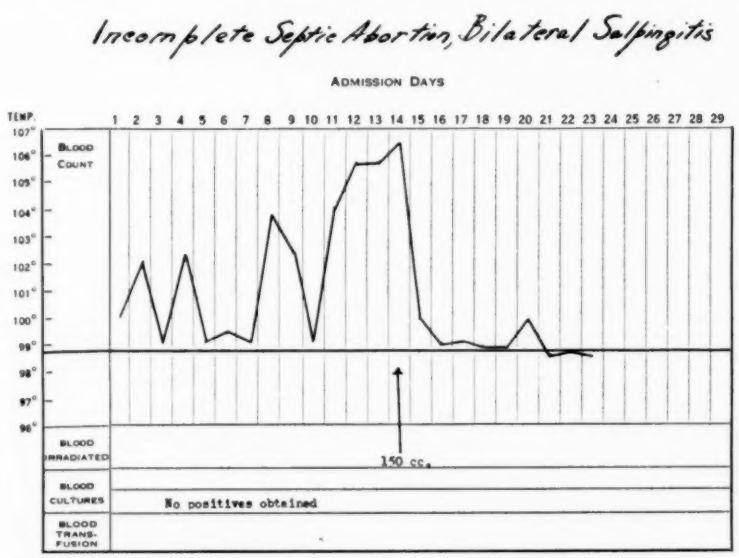


Fig. 5. — In this patient with bilateral salpingitis, and an incomplete septic abortion, blood irradiation was first instituted when the patient was apparently moribund, and her temperature had reached 106.4 F. despite eight days of intensive chemotherapy. On the first post irradiation day her temperature dropped rapidly, and her toxic symptoms began to subside. Forty-eight hours later detoxification was complete. Patient convalesced uneventfully, being discharged nine days after blood irradiation. — (Drs. H. Barrett, W. Schulman, City Hospital, New York.)

The gradual loss of toxicity of meat extracts in which B. botulinus had been grown was noted by Van Ermengem,[35] Thom, Edmonson and Giltner[36] and Schoenholz and Meyer.[37]

The hemolytic toxin of Bacillus proteus was rapidly inactivated by ultraviolet irradiation according to Ecker and Brittingham.[38]

Finally, Macht[39] has described the inactivation of the toxin of pernicious anemia by ultraviolet irradiation.

An interesting feature of all the experimental work is that the rate of destruction of the various bacterial toxins was accelerated both by the presence of oxygen and by exposure of the toxin in a relatively dilute solution; also, the presence of eosin or photosensitive dyes speeded up inactivation of the toxin by ultraviolet rays.

With this vast background of scientific investigation it is not surprising that there has been looked for and observed clinically a marked detoxification effect in patients suffering from profound toxemia secondary to uncontrolled acute pyogenic infection. So constantly has this been noted that I[46] have recently

adopted for a more careful study of this effect the term "detoxification time." The detoxification time is arbitrarily divided into two components, early and complete, which are defined as follows: early, the time in hours which elapses between initial blood irradiation and early signs of subsidence of toxic symptoms; complete, the time in hours elapsing between initial blood irradiation and a complete detoxification effect, i. e. that point at which it becomes clearly evident that the patient's condition is no longer precarious. The average detoxification time as reported by us in collaboration with Rebbeck in 72 consecutive cases of perintonitis may be summarized as follows:

Of 39 patients with generalized peritonitis, 32 recovered—100 per cent of those with moderately advanced peritonitis and 53 per cent of the apparently moribund. In the 32 patients who recovered, signs of early detoxification appeared on the average 34.5 hours after initial irradiation, and the average complete detoxification time was 81.75 hours. Twenty-nine of these patients received one, 6 received two and 4 received more than two treatments.

Ultraviolet blood irradiation therapy used as a control of infection in 20 cases of localized peritonitis and appendical abscess gave the following results: 17 patients recovered—100 per cent of those with moderately advanced infection and 75 per cent of the apparently moribund. In those 17 patients who recovered the average early detoxification was apparent in 24.71 hours and complete in 52.94 hours. Fifteen of the 20 patients had one irradiation, 4 were given two irradiations and 1 had more than two.

Twelve patients suffering with severe pelvic peritonitis accompanied by multiple pelvic abscesses were given ultraviolet blood irradiation therapy with the result that 9 recovered — all 3 of those in whom the peritonitis was moderately advanced and 67 per cent of those who had been thought moribund. In all 12 detoxification became apparent in 54.0 hours on the average; complete detoxification occurred in 10 patients at an average of 90.0 hours after initial blood irradiation. Five patients in this series received one irradiation only, 6 were given two irradiations and 1 had three irradiations.

In the 72 cases of peritonitis reported there were 14 deaths, all 14 occurring in the apparently moribund type of patient, of whom there were 33.

The rapid fall in temperature which occurs after blood irradiation in the majority of patients suffering from acute pyogenic infection uncomplicated by abscess formation or the presence of peritoneal drains may be seen from figures 5, 6, 7 and 8.

The accompanying temperature graphs are typical of cases of acute pyogenic infection complicated either by abscess formation or the presence of a peritoneal drain. In each instance detoxification occurred before the temperature fell to normal, the temperature falling to normal only when a large abscess was evacuated (fig. 9) and when, as shown in the last graph (fig. 10), the peritoneal drain was removed.

3. *Increased Venous Oxygen.* — The ability of irradiated blood or plasma to pick up oxygen has been demonstrated by Mayerson and Laurens[40] and by Harris.[41] Miley[41a] reported that there appears one hour after ultraviolet blood irradiation therapy a marked and persistent rise in the venous oxygen content of patients with abnormally low venous oxygen values. This rise was usually associated with improvement in the patient's general condition and skin coloration, with no compensatory rise in hemoglobin content or red cell count which could possibly account for it. Consequently, it is my impression that blood is enabled to pick up more oxygen after blood irradiation than without irradiation in patients with low venous oxygen values. The relationship of oxygen to detoxification by ultraviolet irradiation in experimental work has already been mentioned; no comment can be made at this time on the relation between

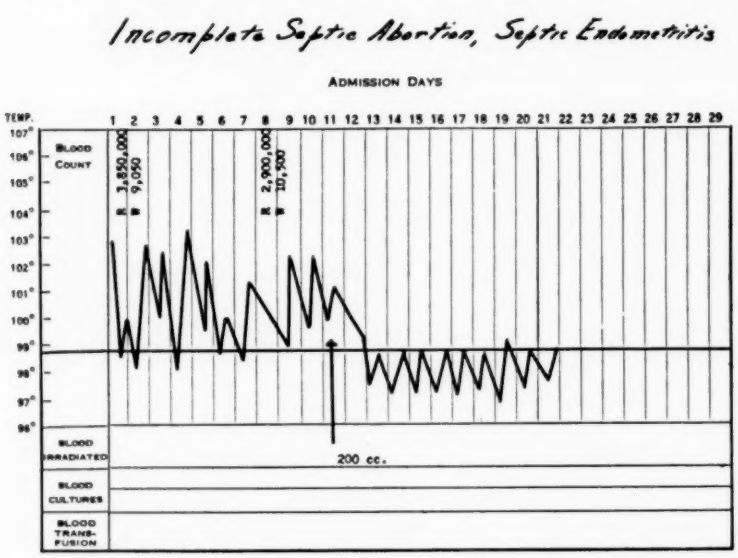


Fig. 6. — In this case of incomplete septic abortion, and septic endometritis, one week of intensive chemotherapy, and three days withdrawal of chemotherapy had failed to control the progress of the infection, so that at the time of blood irradiation the patient was extremely debilitated, toxic and jaundiced. On the first post irradiation day her toxic symptoms began to subside, and forty-eight hours after blood irradiation therapy she was obviously out of danger, detoxification being complete at this time. — (Drs. H. Crowther, G. Miley, Hahnemann Hospital, Philadelphia.)

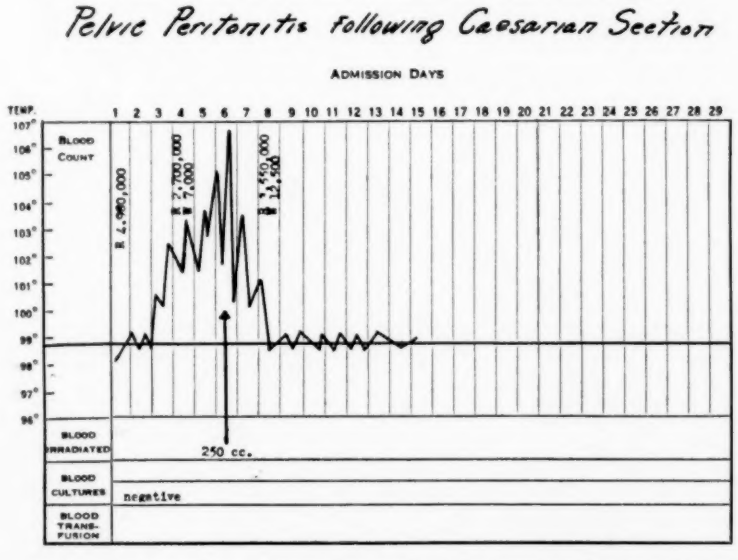


Fig. 7. — In this patient suffering from severe pelvic peritonitis following Caesarean section, it was observed that after twenty-four hours intensive chemotherapy the red count had begun to fall, and the temperature to rise, with an associated rapid deterioration of her general condition. Blood irradiation was instituted when the temperature reached 106.8 F.; within the next twenty-four hours patient's symptoms subsided markedly, and detoxification was complete in another twenty-four hours. Patient's convalescence was uneventful. — (Drs. N. Paxson, G. Miley, Hahnemann Hospital, Philadelphia.)

detoxification and increased venous oxygen following ultraviolet blood irradiation therapy.

4. *The Vaccine Effect.* — Much experimental work has been done in producing various bacterial and virus vaccines with ultraviolet energy. The fundamental theory behind this work is that ultraviolet irradiation may often inactivate the

toxic properties of bacteria and viruses, even such substances as snake venoms[18, 19, 20, 21] without destroying their respective antigenic properties. According to Trotskii,[42] bacteria killed by ultraviolet light lose a considerable part of their toxicity toward laboratory test animals but completely retain their antigenic and immunizing characteristics.

Smithburn and Lavin[43] demonstrated that suspensions of tubercle bacilli which had been irradiated with monochromatic ultraviolet light (2,537 angstrom units) are rendered avirulent and viable and so possess the capacity of producing demonstrable immunity. Hodes, Webster and Lavin[17] have shown that the rabies virus exposed to mercury-vapor lamp rays loses virulence yet retains considerable immunizing potency for mice. Morgan and Lavin[41] have produced a noninfective immunizing antigen by ultraviolet irradiation of the virus of Eastern equine encephaloymelitis.

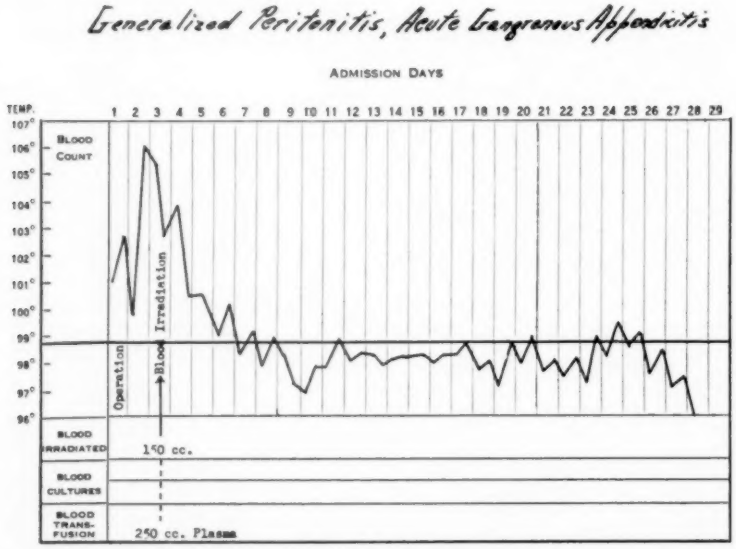


Fig. 8. — At the time of blood irradiation this individual was in profound shock secondary to an overwhelming toxemia, and general peritonitis following removal of a gangrenous appendix forty-eight hours previously. Despite shock 150 cc. of the patient's blood was withdrawn and irradiated. Within a few minutes following the return of the irradiated blood the patient's pulse began to improve markedly. The classical signs of shock disappeared. Nevertheless, 250 cc. of plasma was given. On the first post irradiation day the patient was able to sit up in bed, and write a letter, definite objective evidence of a dramatic detoxification effect occurring in this person; his convalescence from this point on was uneventful. — (Drs. F. Bristol, G. Miley, Hahnemann Hospital, Philadelphia.)

In respect to vaccine effects found clinically after ultraviolet blood irradiation, the following meager but stimulating observations have been made:

In 11 patients suffering from severe and intractable furunculosis of six months' to 6 years' duration a complete subsidence of the acute stages of the disease and a lack of recurrences were observed after two to four blood irradiations given at two to five week intervals. One patient when first seen was suffering from the daily appearance of forty to sixty new boils; four blood irradiations were necessary before complete subsidence of the disease process occurred. The patient has been placed on a schedule of two to three blood irradiations per year, and his recurrence furunculosis has been well controlled for the last three years.

Six patients with intractable herpes zoster — 4 in the acute and 2 in the chronic stage have been treated with ultraviolet blood irradiation therapy. The 4 patients treated in the acute stage are known to have had no recurrences after

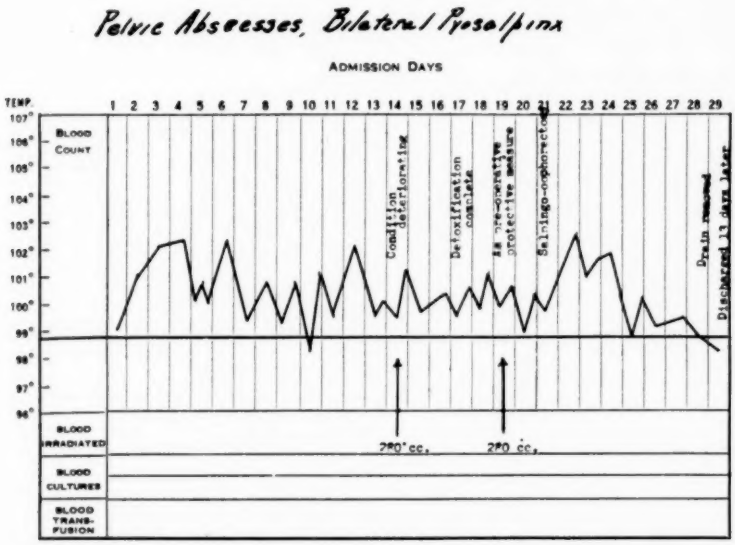


Fig. 9. — The condition of this patient suffering from multiple pelvic abscesses, and bilateral pyosalpinx, deteriorated constantly despite conservative treatment, and with the appearance of toxic symptoms on the 14th hospital day blood irradiation was instituted. Twenty-four hours later detoxification had begun, and was complete at the end of seventy-two hours, although her temperature remained elevated due to the presence of a nonvacuated accumulation of pus in the pelvis. Forty-eight hours after a second preoperative blood irradiation, salpingo-oophorectomy was performed. Following evacuation of this large focus of infection the temperature fell to normal, and the patient convalesced uneventfully. — (Drs. E. Craig, E. Hessert, Hahnemann Hospital, Philadelphia.)

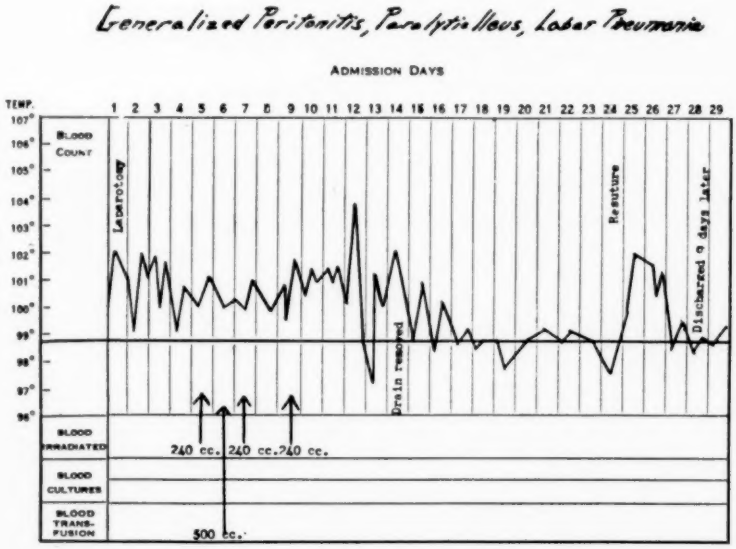


Fig. 10. — At the time of initial blood irradiation this patient suffering from generalized peritonitis secondary to gangrenous appendicitis, and with a four and one-half day history of paralytic ileus, had just developed lobar pneumonia, and was extremely dyspneic and cyanotic. In the first few minutes following initial blood irradiation the patient's dyspnea and cyanosis dramatically disappeared. However, a second and third irradiation was necessary before the patient's toxic symptoms subsided. His temperature remained elevated despite the subsidence of toxic symptoms until removal of a peritoneal drain. From this point on the patient, except for a slight rise in temperature following resuture of the abdominal wound, convalesced quite well, and was discharged from the hospital thirty-three days after initial blood irradiation. — (Drs. E. Dickinson, G. Miley, Hahnemann Hospital, Philadelphia.

a subsidence of the acute symptoms of the disease, forty-eight to seventy-two hours following blood irradiation; 1 of the 2 patients with chronic herpes zoster has been markedly relieved of symptoms, while the other has not been heard of since his original blood irradiation.

The production of a vaccine effect seems to have occurred in the cases of chronic furunculosis mentioned. Whether or not this has occurred in the cases of herpes zoster mentioned seems problematic but worthy of mention.

5. *Photosensitization.* — In 1897 Raab[45] first noticed and described the lethal action of acridine on paramecia exposed to light contrasted with its non lethal action in the absence of light. This phenomenon was called photodynamic action or photosensitization. Jodlbauer and Tappeiner[23, 46] soon afterward followed up this discovery with a series of brilliant experiments showing that sensitization of a biologic system to visible and ultraviolet light can be produced by various fluorescent dyes. Today the chief concern is the fact that sulfa drugs produce photosensitization and photoallergic effects in man. This principle has been described by Epstein[47] and Blum.[48] I[4d] have reported recently the presence of untoward photosensitive effects, such as convulsive seizures, renal shut-down and a rapid increase in toxic symptoms when sulfanilamide, sulfathiazole or sulfapyridine was given within the first four or five days after ultraviolet blood irradiation therapy and the complete absence of such effects when ultraviolet blood irradiation therapy was given as soon as an hour after the blood levels of these drugs had been ascertained to be at a maximum of tolerance.

6. *Other Effects.* — Vasodilation, desensitization and a reduction of edema have been observed to occur frequently, but no statistics are available concerning these effects.

Clinical Applications

Several and varied clinical applications of ultraviolet blood irradiation therapy have been made, and as a result a few general statements can be made at this time as to the value or lack of value of this method in the following conditions:

1. *Acute Pyogenic Infections.* — In 1934 Knott and Hancock[1] first reported the recovery, following ultraviolet blood irradiation therapy, of 2 patients with apparently hopeless septicemia. In 1940 and again in 1942 Miley[4b, d] made several clinical observations on patients with acute pyogenic infection given blood irradiation, notably both a marked bactericidal and a rapid detoxification effect. These were confirmed soon afterwards by Rebbeck.[2] Throughout this work with acute pyogenic infections a large number of chemotherapeutic failures was met with. The majority of those patients in whom sulfa drug therapy had obviously failed were apparently moribund at the time of initiation of ultraviolet blood irradiation therapy. Sixty to 75 per cent of all chemotherapeutic failures were found to show marked bactericidal and detoxification effects after blood irradiation. Recently, Miley and Rebbeck[4e] jointly reported that blood irradiation had been used with most encouraging results in 72 unselected cases of severe and advanced peritonitis, including the recovery of 20 out of 29 apparently moribund patients in whom sulfa drug therapy had failed to control infection.

2. *Preoperative Protection.* — Blood irradiation has been used as a preoperative, protective measure before operations on septic patients. Rebbeck[24] recently has been able to demonstrate conclusively the protective preoperative effect of ultraviolet blood irradiatin therapy in cases of incomplete septic abortion. Briefly summarizing his recent and brilliant contribution one finds:

Twenty-two patients with postabortional sepsis were given ultraviolet blood irradiation therapy.

Practically no increase in temperature was noted after operation when hemoirradiation was administered preoperatively, nor was any other untoward effect observed.

In 15 cases operation was performed within twenty-four hours after blood irradiation.

A definite protective effect was obtained against the usual disastrous spread of infection in the pelvis or into the blood stream.

Convalescence time varied from five to thirteen days.

3. *Intrinsic Bronchial Asthma.* — All that can be said about the use of blood irradiation in intrinsic bronchial asthma at this time is that it has been used for three and one-half years and the results have been sufficiently encouraging to justify continuing this therapy until a five year study has been completed.

4. *Chronic Arthritis.* — Over 200 patients with chronic atrophic or hypertrophic arthritis have been given ultraviolet blood irradiation therapy. The data on these have been collected only over a period of three and one-half years, and until a five year study has been made no report can be given. The results have been sufficiently encouraging to justify continuing this work in collaboration with the arthritic clinic.

5. *Other Diseases.* — This method has been used sporadically in many other disease processes, and I have never seen any response whatever in neoplastic diseases, leukemia, psoriasis or Hodgkin's disease.

Potentialities of Ultraviolet Blood Irradiation Therapy

The potentialities of ultraviolet blood irradiation therapy as an adjunct to the intelligent practice of medicine and surgery are unlimited in comparison with the present knowledge of the subject. It is my personal opinion that the future of ultraviolet blood irradiation therapy is necessarily closely connected with the reproduction of the biochemical and physiologic effects of ultraviolet energy both known and unknown.

Its future use in combating the tubercle bacillus represents a lifetime work for many investigators.

The early application of blood irradiation in anterior poliomyelitis and various forms of encephalitis seems to me to be a fertile field for investigation. The 2 cases of anterior poliomyelitis in which it has been used, once by Moser[49] and once by Hancock,[50] showed a rapid subsidence of both the toxic and the paralytic signs and symptoms.

At present it is the opinion of all of us who are working with ultraviolet blood irradiation therapy that our efforts should be directed primarily to discovering all possible applications of this method to war medicine. The two applications that we all feel to be of sure and practical value in war medicine are (1) in the field of chemotherapeutic failures, and (2) in the treatment of chronic nonhealing wounds. A third application, of theoretical but probable value, would be in the acute toxemia of burns.

1. *Use in Chemotherapeutic Failures.* — Of 151 consecutive patients[47] with acute pyogenic infection given blood irradiation, 57 were obvious chemotherapeutic failures: 12 were in an early or moderately advanced stage, and 45 were apparently moribund. After blood irradiation 11 out of the 12 recovered uneventfully. Nineteen in the apparently moribund group recovered, and the remaining 26 were uninfluenced either by blood irradiation or by sulfa drug therapy. Of the 26 combined blood irradiation and chemotherapeutic failures, 9 had bacterial endocarditis and 7 had Staphylococcus aureus septicemia. I have never seen either of these diseases influenced by blood irradiation, although recovery has been observed in Staph. aureus septicemia following blood irradiation

by Rebbeck[51] in 2 cases and by Barrett[52] in 1 case. If all cases of bacterial endocarditis and Staph. aureus septicemia are excluded, there are a total of 31 recoveries among 41 cases of obvious chemotherapeutic failure, which is roughly 75 per cent. If only cases of bacterial endocarditis are excluded, and certainly they must be excluded in any consideration of infections due to war wounds, 31 out of 48 patients recovered. Therefore, according to the presence or absence of Staph. aureus septicemia, recovery may be expected after blood irradiation in 60 to 75 per cent of all chemotherapeutic failures to control infection.

It seems apparent, in view of the previously mentioned report made in collaboration with Rebbeck,[46] in which it is stated that 20 out of 29 patients in whom chemotherapy failed to control advanced peritonitis recovered after blood irradiation, that blood irradiation is the procedure of choice when sulfa drug therapy has failed to control infection.

2. *Use in Chronic Nonhealing Wounds.* — It is generally recognized today that there occurs in a low percentage of persons who have recovered from acute wound infections a failure in healing of the wound or wounds despite the very best local treatment plus normal supportive measures, such as infusions and transfusions and adequate diet. This failure has been considered due to the absence in such persons of a specific resistance factor, intrinsic in nature and of unknown composition, often referred to loosely as a general resistance factor. In any case, wounds do not heal in these few patients, as contrasted to the relatively rapid healing of wounds in most persons. During the last three and one-half years we have had occasion to use ultraviolet blood irradiation in the treatment of 7 such patients; the duration of the nonhealing wound varied from two months to six years. The lesions may be described briefly as fecal fistula in 2 cases, multiple and extensive lesions of skin and muscle in 2 cases, postincisional failure of abdominal fascia and muscle to close despite numerous resuture attempts in 1 case, a 4 by 6 inch leg ulcer in 1 case and a nonhealing amputation stump in 1 case. The rapid appearance of wound healing and the recovery of all 7 of these patients in most convincing fashion has led us to believe that in each instance ultraviolet blood irradiation therapy supplied the necessary and lacking intrinsic or general resistance factor, which all other known types of therapy had failed to do.

It is impossible at this time to estimate the probable number of nonhealing wounds which will occur during the coming struggle, but we feel that in those instances in which wounds have not healed after two to three months of all other types of therapy, ultraviolet blood irradiation therapy should be administered.

3. *Use in Acute Toxemia of Burns.* — A logical experimental application of blood irradiation to war medicine, in view of its known detoxification effect in acute pyogenic infections, would be in those cases of severe burns with acute toxemia. We have no experience with this type of detoxification but feel the possibility worthy of mention.

Summary

1. A method of irradiating human blood, that originally devised and recently modified by Knott, is described. This consists of withdrawing and citrating a predetermined amount of a patient's venous blood and immediately returning it intravenously through a closed system containing a Knott irradiation chamber, at which point intense ultraviolet irradiation is applied.

2. The amount of blood used (predetermined according to approximate body weight), the time of exposure (optimally ten to twelve seconds in the treatment of acute pyogenic infections) and the wavelengths and intensity of

the spectral energy used form the basis for estimating and maintaining a relatively constant dosage.

3. The reproduction of several known biochemical and physiologic effects of ultraviolet radiation has been observed. They are the bactericidal, detoxification, vaccine and vasodilation effects, plus an increase in oxygen content of irradiated venous blood with abnormally low oxygen content.

4. This method has been applied clinically in acute pyogenic infections and as a preoperative, protective measure in septic cases; in both instances excellent results have been obtained. The exceptions in the former have been all cases of Staph. aureus septicemia and bacterial endocarditis. Its present use in other fields of medicine is mentioned, as are its potentialities.

5. The application of blood irradiation to war medicine in the near future is urged; its use in chemotherapeutic failures and in chronic, nonhealing wounds is considered the most practical field of application in war medicine.

6. It is obvious that we have employed this method whenever we have felt that patients would be benefited by a bactericidal and detoxification effect, a vaccine effect, an enhancing of the ability of the blood to pick up oxygen or a vasodilation effect. We have come to regard this therapy not as a specific for any one disease necessarily but as a method of applying various known physiologic and biochemical effects of ultraviolet radiation whenever they are indicated. We feel that this method may be likened to the use of saline and dextrose infusions in patients in whom clinical evidence of dehydration and anhydremia exist.

Conclusions

1. Ultraviolet blood irradiation therapy is a practical method of reproducing bactericidal, detoxification, vaccine and vasodilation effects and as such represents a valuable adjunct to the practice of medicine and surgery.

2. Its use is indicated in war medicine for the treatment of chemotherapeutic failures and chronic nonhealing wounds, and its adoption by medical departments of the armed forces is urged.

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TWO POINT COAGULATION

A Follow-up Report on a New Technic and Instrument for Electrocoagulation in Neurosurgery

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Two years ago a new technic and instrument for electrocoagulation to be used in the practice of neurosurgery were introduced.[1] It was believed at that time that much could be accomplished by this method which was impossible by the usual procedure. Since then the two point coagulation forceps has been used in 257 major neurosurgical procedures not including ventriculography, trephining and other minor operations. It is now the only means of coagulation I use with occasional exceptions. It has not yet found general favor, probably for two reasons: (1) because a mechanically sound instrument has not been achieved except by one instrument maker* and (2) because some of the surgeons who have tried it have not realized that there is a certain art in its use and that only practice can achieve the good results which are possible.

The usual method of coagulation has certain definite dangers, these being chiefly production of excessive heat, shrinkage of the blood vessel or surrounding tissue, especially the dura, explosion of a blood vessel and production of heat in a blood vessel at a distance from the point of coagulation and often deep within the brain. For this reason some neurosurgeons have tried to dispense with electrocoagulation entirely. In my original paper I pointed out how some of these objections could be reduced even with the older method of electrocoagulation.

In the two point coagulation method there is no connection to the body of the patient and the current flows only between the tips of a small pair of bayonet forceps (fig. 1). Thus when the forceps is closed tightly on a blood vessel the gap across which the current flows is extremely narrow, with the result that there is little production of heat. In actuality this results in a short circuit of the electrocoagulation machine, but this does no harm as the short circuiting of high frequency output reduces rather than increases the load.

This principle has not been used before except in an instrument for the removal of tonsils in which the tips of the electrode were kept constantly separated. In no other instrument has there been provision for the tips to be brought together in direct contact with and compressing the vessel or area to be coagulated. In this method there is no visible or actual spark at any time. The current necessary is only one-fourth to one-third of that usually used for coagulation.

Points to be observed in the use of the coagulation forceps are as follows:

1. The vessel or point to be coagulated must be accurately caught between the tips of the forceps.
2. The forceps should grasp the vessel before the current is turned on.
3. Coagulation should be done with a little saline solution running over the area to prevent sticking and to cool the surrounding tissue.
4. The time of coagulation should be minimal; too much will produce some sticking and unnecessary hardening of the vessel.

* Pendleton & Arto Co., of Houston, Texas. The instrument manufactured by this company is mechanically sound but can be obtained only in limited numbers until after the war.

5. Cortical vessels may be picked up and coagulated, and the whitened areas thus produced may be sectioned with a scalpel and the incision carried through the lobe of the brain, with additional vessels being picked up as they are cut across. A rapid, dry method for lobectomy is thus possible.

6. A coagulation current rather than a cutting current should be used, since it is much cooler.

With practice a simple rapid technic is soon learned.

In my previous report a switch was described which allowed a change from the new connection back to the old in circumstances under which such a change might be necessary. This switch has been eliminated, as the older method is now rarely used. If it becomes necessary to coagulate the inside of a capsule or to remove a tumor with the cutting loop it is simple enough to connect the body electrode to the machine again. The coagulation forceps has also been changed so that the cord comes off the lower side, passing

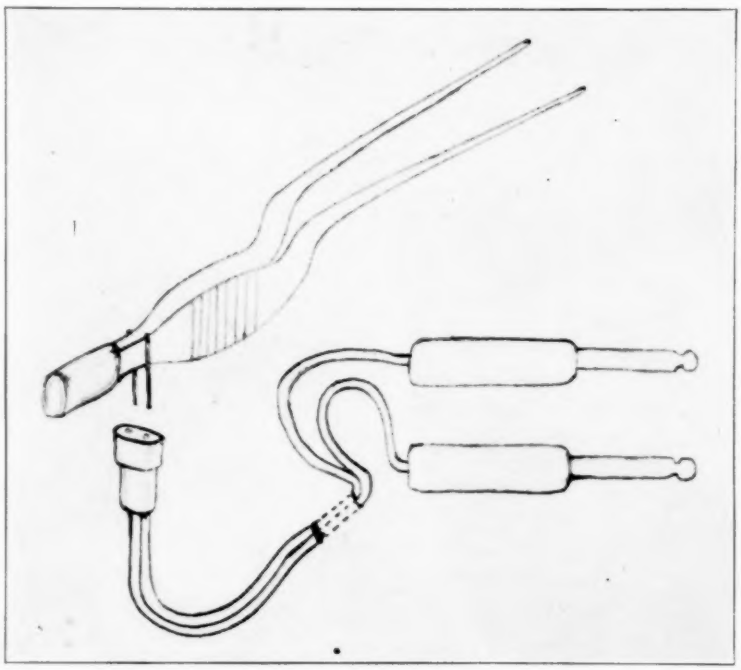

Fig. 1. — Ten foot double cord.

through the palm rather than over the back of the hand (fig. 2). This helps the balance of the instrument and makes it easier to handle.

I have not used silver clips in over two years. I feel more sure than ever that use of the two point forceps is a useful method with definite advantages.

Dr. George Waldron tried it in a radical mastectomy and noted that he could obtain better hemastasis than by any other method. It may, therefore, have some possibilities in general surgery.

There are certain situations in which the instrument now seems almost indispensable. Examples are coagulation of the vessels of the dura, in which shrinkage is practically eliminated, and lobectomy and coagulation of the larger arteries, such as the middle meningeal, superficial, temporal and occipital arteries in which the method works perfectly. I believe that the method might be used even on the carotid artery but have not tried to do

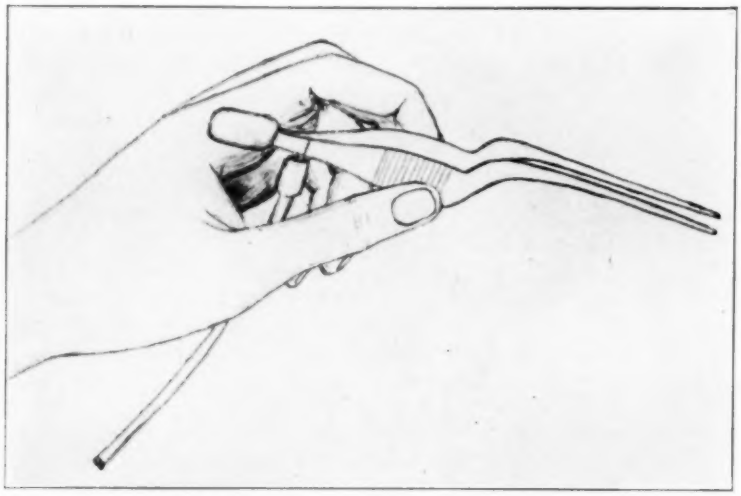

Fig. 2. — Double cord, one to each blade; no connection to patient.

so. For over two years I have had no hesitancy in turning a flap across the superior sagittal sinus, the transverse sinus and, in one instance, the torcula. The removal of the choroid plexus in infants is much easier, since the coagulation does not extend into the ventricular wall and after coagulation the plexus may be simply lifted and cut away, leaving a dry ventricle.

Certain specific cases should be cited to illustrate procedures which would be difficult by any other method of hemastasis. It was used in the removal of an ependynoma extending over seven laminas. After midline section of the cord, the vessels going into the tumor from the central canal were coagulated, and complete recovery occurred. A 64 Gm. acoustic neurinoma was removed, the vessels connecting the tumor to the pons and the medulla being coagulated. Two colloid cysts of the third ventricle and an ependymoma of the third ventricle were removed. In the last 3 cases, vessels running into the wall of the third ventricle were coagulated. All the patients recovered. The coagulation and removal of spinal epidural varicosities, the presence of which I believe to be rather common, is also made possible.

Summary

1. The principle and the technic of two point coagulation in neurosurgery are reviewed and additional observations made.

2. The advantage of this method over the usual method of coagulation in minimal heat production, minimal shrinking and greater speed and safety are emphasized.

3. Additional observations on how best to use the instrument are enumerated.

4. Specific neurosurgical cases which could not have been easily handled by any other method are cited.

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(Special Article)

ATTENDING THE KENNY COURSE AT THE UNIVERSITY OF MINNESOTA

It was instructive and inspiring to attend the fifth of the Continuation Courses arranged for physicians in The Kenny-Technic for Infantile Paralysis at the University of Minnesota, held from August 10th to 15th. The spacious campus of the University, the second largest in the country, is spread among beautiful landscaping on a high bank of the Mississippi River. Participants of the course came from all parts of the United States and Canada; they lived at the Center for Continuation Study, a modern building housing the registration office as well as the spacious lecture parlor in which many of the lectures were given and round table discussions were held. The clinical part of the course was given at the three hospitals in which patients are being treated according to the Kenny Technic and periodically reexamined; the University of Minnesota Hospitals at the University grounds, the Minneapolis General Hospital in downtown Minneapolis, and the Gillette State Hospital for Crippled Children on the outskirts of St. Paul; facilities for transportation were provided by the University. The faculty of the course consisted of: Miland E. Knapp, M.D., Clinical Assistant Professor of Physical Therapy, Director of Department of Physical Therapy; Wallace H. Cole, M.D., Professor of Orthopedics; Marian Denny, Head Technician, Department of Physical Therapy, Gillette State Hospital for Crippled Children; Valerie Harvey, Special Guest Instructor, Department of Physical Therapy; Herman Kabat, Assistant Professor of Physiology; J. M. Nolte, Director, Center for Continuation Study; William A. O'Brien, M.D., Director, Postgraduate Medical Education; John F. Pohl, M.D., Clinical Instructor in Orthopedics; Sister Elizabeth Kenny, Special Guest Instructor, Department of Physical Therapy; A. V. Stoesser, M.D., Associate Professor of Pediatrics. The same faculty is responsible for the course for physical therapy technicians and for hospital nurses. The program of all of these courses is constantly revised as experience warrants; the stay required for technicians varies from a minimum of two to six months according to the qualifications and abilities of the student.

A large amount of theoretical instruction and practical clinical work was crammed into the physicians' course which lasted six days. The first morning there were talks on "orientation," on the principles of the Kenny treatment and on pathology; in the afternoon a clinic and movies of acute cases. Ten-minute stretching periods between lectures and tea time from 4 to 4:30 in the homey lounge served for relaxation, social intercourse and much animated discussion. Because of the seemingly unorthodox views and procedures displayed at the course, participants were asked to refrain during the first two days from too much debate during the lectures, until they had heard and seen all the evidence. Later they were directly encouraged to discuss and to ask questions. On all other mornings there were first clinical visits to hospitals; the subsequent lectures included "Muscle and Nerve Physiology," "Principles of Treatment," "Muscle Spasm," and "Physiology Applied to the Kenny Technic." On the last three days special emphasis was placed on the demonstration of the reeducation technic at the clinics and to round table discussions at the Center with all members of the faculty present.

The principles of the Kenny Treatment have been fairly well broadcast by this time and were fully described in the July number of the ARCHIVES. It is based on a new conception of the physio-pathology of infantile paralysis. Miss Kenny, whose personality naturally dominates the entire scene, rightfully places great emphasis on the fact that her treatment does not just consist of "hot foments" which anyone can apply, and all those who have actually seen the carrying on of her painstaking and minute muscle treatment technic and its remarkable results will give due credit to her for her power of observation and her dogged determination which brought about a complete revolution in a treatment technic for infantile paralysis. We have seen daily a dozen or more parallel cases which showed the difference in results between the orthodox and the new method. In the cases treated from the start with the Kenny Technic and now observed for upward of two years, there were no deformities, no scoliosis and little of the withered appearance of the affected extremities. Although some of the patients had residual paralysis of one or two muscles to that of almost the entire leg they walked without braces. Dr. Pohl, the orthopedic surgeon, stated that out of 62 patients treated with the Kenny Method in one hospital, braces were only required in 2. It seemed to us all that once the new conception of the disease is fully understood and accepted there will be a complete reversal or rather absence of the present day universal employment of splinting, braces and operative after-treatment. Miss Kenny went even so far as to suggest that most of the underwater treatment pools should be filled up with soil and used as flower beds. She insists that poliomyelitis as it is seen and treated by her now is an entirely different disease from that seen and treated in the orthodox sense.

The principal difference in the new and old conception of the disease as it crystallized in the minds of most of us attending the course, is that poliomyelitis is not simply an affection of the anterior horn cells of the spinal cord, but it also simultaneously and perhaps predominantly directly attacks the muscles and also interrupts their connection with the anterior horn cells and the centers higher up. Widespread spasm in both paralyzed and non-paralyzed muscles exists in all cases as demonstrated by Miss Kenny and her co-workers and it seems likely that the unrelieved muscle spasm was responsible for most of the permanent damage in the cases treated by orthodox immobilization. Persistent shortening of muscles due to spasm was demonstrated in many of the chronic cases unsuccessfully treated by the "old method." Muscle spasm evidently plays a role in the two other cardinal symptoms so forcefully described by Miss Kenny, those of "mental alienation" and of "incoordination." These terms are decidedly confusing to the average physician and will undoubtedly be replaced by more fitting terms once their full physiologic implication is understood. "Physiological block" or "reversible paralysis" may be more explicit than mental alienation and "substitution" better than "incoordination." There can be no doubt that this triad of cardinal symptoms and especially muscle spasm has been completely overlooked under the old routine management of infantile paralysis. There will be cases of residual paralysis even under the newer method of treatment, for there is still no way to restore completely destroyed anterior horn cells, but the repeated demonstrations during the course convinced all of its participants that if muscle spasm and the other two factors are promptly and efficiently dealt with, the residual paralysis will be minimal and there will be none of the mental and physical wrecks hobbling about even at this time in spite of all the expensive pool and operative treatment. Even the most skeptic orthopedic men in the group became convinced that the method

evolved by Miss Kenny will be the basis for future treatment of infantile paralysis. At the same time we all realized that many basic problems of the disease and its treatment are still without solution. Some of these are: the possibility of affecting the polio virus in the anterior horn cells before it had time to destroy them completely, the explanation why spasm comes about, the mode of action of the hot foments and a controlled investigation of the action of other forms of heat, the effects of muscle contracture and so on. It will require much laboratory and clinical study to clear up these and many other phases of the complex problem of poliomyelitis. From the practical standpoint, however, the most urgent problem is how to spread the actual use of the new method as rapidly as possible, so as to avert the large incidence of crippling with the older method. Physical therapy physicians and technicians should play the leading role in the carrying out of this work and should assist in much of the research.

Dr. Miland E. Knapp was a thoughtful and efficient host and his lectures were all to the point and easily understandable. All the members of the faculty valiantly cooperated with Miss Kenny. The steadily increasing record of attendance of these courses is the best proof that they fill a definite need, the registered attendance of the five successive courses being 10, 11, 24, 26, 37 respectively. The medical profession owes a debt of gratitude to the University of Minnesota and the National Foundation for Infantile Paralysis for bringing about these instructive courses. They give physicians an opportunity to appreciate at first hand the possibilities of the Kenny treatment and convince them that the successful use of its technic requires not only a thorough study of kinesiology but also well supervised and practical work in its employment over an extended period.

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Gustav Kolischer

In the death of Dr. Gustav Kolischer, which took place on August 11, 1942, the medical profession lost an outstanding figure, especially in the field of modern urology.

A native of Austria, Dr. Kolischer obtained his classical and medical education in the capital of that country and was graduated with high honors from the medical faculty of the University of Vienna in 1886, at the age of twenty-three. He satisfied the exactions of the government by serving a year as a junior medical officer in the army and then entered private practice. At that time he was especially interested in the comparatively new method of cystoscopy in which he became proficient.

Married to the daughter of the famous otologist, Professor Gruber, temperamental differences which were not overcome even after the birth of two daughters, resulted in separation and his emigration to Chicago after fourteen years of practice in Vienna. He at once became known as a skillful urologist, though he did not strictly limit himself to that specialty. His practice extended to the fields of operative gynecology and obstetrics, in which latter specialty he employed the European method of teaching groups of practitioners. Later he was also professor of Urology in the Chicago Post-Graduate Medical School. An aggressive debater he was often heard in medical societies, specialistic as well as general and not a few men who presented allegedly original contributions were publicly exposed by his naming of the true originators. Possessed of an uncanny memory, he never looked at his manuscripts when presenting a paper, and his discussants, who were provided with advance copies, often marveled at his ability to repeat word for word what he had dictated to his stenographer. This uncanny memory served him well also in citing literary references.

A member of the American Urological Association and of the Chicago Urological Society, of which later he became president, he extended his interest also to the field of physical therapy and electrosurgery. He did considerable work with diathermy in the management of bladder tumors, benign as well as malignant. In spite of an extensive practice, he not only found time to prepare many papers, but also a masterly translation into German

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ARCHIVES of PHYSICAL THERAPY

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

.·. EDITORIALS .·.

OXYGEN AND FEVER THERAPY

Cullen, Weir and Cook in the current issue present the results of an investigation of considerable interest from various points of view. Their article indicates the modern trend of deriving scientific benefit from clinical observations.

The literature is replete with articles on fever therapy as such, and some physicians working in this field had recognized a number of the classic symptoms of oxygen want in patients subjected to hyperpyrexia. Nevertheless, all too few of them tried to correct the condition by the obvious method of increasing the partial pressure of oxygen in the lungs. Those who did use oxygen therapy noted the benefits in marked reduction of circulatory disturbances and particularly in the increased comfort of the patient. From the viewpoint of this observer it seems fair to say that the relatively few physicians who have tried oxygen therapy with fever therapy have continued to use it.

Adams and Boothby in the *Journal of Biological Chemistry* for May, 1936 mentioned the elevation of the oxygen content of venous blood during fever therapy, and the various conditions precedent to the desirability of oxygen therapy were sharply defined by F. W. Hartman in *The Journal of the American Medical Association* for December 25, 1937.

It may therefore be said that the symptoms of oxygen want in patients undergoing fever therapy have been recognized and pointed out for some time, but strangely enough only relatively few physicians have prescribed this somewhat evident treatment. The present authors have pointed out a reasonable explanation for the various factors involved and for the beneficial results obtained. Nevertheless, it is not even necessary to agree with their clever conclusions as to the underlying causes of anoxia as observed in the clinical application of fever therapy, because there can be little arugment against their statement that the administration of oxygen greatly benefits the patient.

It is interesting to note that the development of oxygen therapy and of fever therapy in the last few years were somewhat parallel, but apparently the widespread use of oxygen therapy has outdistanced the more limited field of fever therapy. This situation naturally was greatly influenced by the development of increasingly simple and inexpensive apparatus for the administration of oxygen and the universal distribution of U. S. P. oxygen in large, industrial-sized cylinders.

The authors administered oxygen by the oropharyngeal catheter technic, which is simple and generally available. Higher concentrations may be obtained by the use of suitable masks; such masks are now available in a right angle pattern, so that the wall of the fever cabinet will not interfere with the treatment, and the nasal type of mask leaves the mouth free for the administration of salt, liquids or other medication as indicated.

In the discussion the authors point out that the administration of oxygen benefits the patient chiefly by physical methods. It is pleasant to note

the clarity of this statement, because after all the whole procedure is for the benefit of the patient, regardless of the complexity or simplicity of the method utilized. It is obvious that the use of oxygen therapy with fever therapy is a most interesting example of mechanical analogues which may be referred to, especially in teaching. No doubt the authors will not stop at this point, and we shall be interested in the reports of further progress along this line of investigation.

THE WAR MANUAL OF PHYSICAL THERAPY

The Division of Medical Sciences of the National Research Council was asked to furnish the Medical Departments of the United States Army and Navy with a compact presentation of necessary information on physical therapy to be employed by medical officers during the present war.

In response to this request, such a manual was prepared by the Division's Subcommittee on Physical Therapy in conjunction with the Council on Physical Therapy of the American Medical Association and under the editorship of the Committee on Informaion of the Division of Medical Sciences of the National Research Council.

This brief and concise manual was published in *War Medicine* for March, 1942, and has now been reprinted by the Council on Physical Therapy of the American Medical Association for free distribution to all regular Army and Navy medical officers who are on active duty. Any interested medical officer can obtain a copy of the manual without charge by writing to Mr. H. A. Carter, secretary of the Council on Physical Therapy of the American Medical Association, at 535 North Dearborn Street, Chicago, Illinois.

The manual is not intended to serve as a guide for physical therapy aides who apply physical treatment, nor is it supposed to be a guide to proper methods of physical treatment for medical officers in charge of physical therapy departments in military hospitals. Its primary purpose is to provide information for the average medical officer serving in other fields concerning the scope of physical therapy and to present authoritative information concerning the indications for the employment of physical agents.

The information which the manual contains has been compiled from reliable articles previously published under the auspices of the Council on Physical Therapy of the American Medical Association and carefully condensed and edited by the members of the Subcommittee on Physical Therapy of the Division of Medical Sciences of the National Research Council. Various other committees or subcommittees of the National Research Council were asked to criticize certain sections which dealt with their own particular specialty so that the manual, in its final form, can be considered extremely reliable.

There are discussions concerning the physical treatment of arthritis, sprains, dislocations, traumatic synovitis, contusions and muscle strains, Volkmann's contracture, bursitis, tenosynovitis, fractures, peripheral nerve injuries, stiff joints and amputations. Likewise, there are sections dealing with circulatory diseases, painful feet, backache, cerebral spastic paralysis, resistant gonococcic infection, dementia paralytica, cutaneous diseases and tuberculosis. The manual ends with a discussion of physical treatment in psychiatry and neurology.

This booklet is only thirty-five pages in length but it is packed full of authoritative advice on the employment of physical agents. Physicians who are not on active duty in the Army or Navy can obtain this booklet from the Council on Physical Therapy at a cost of 25 cents. It is believed that the War Manual of Physical Therapy should be in the hands of every Army and Navy medical officer and that it can be read with profit by every physician.

NEED FOR NURSES AND PHYSICAL THERAPY TECHNICIANS

The following article, with which we are heartily in sympathy, is reprinted from the "National Foundation News" (National Foundation for Infantile Paralysis) for July, 1942.—Ed.

Satisfactory treatment of infantile paralysis calls for the services of nurses and physical therapy technicians, as well as those of doctors. The more severe and protracted the case the more such care is needed. The use of physical therapy early in the care, as advocated by Miss Kenny, has increased the need for trained workers.

The nursing profession is old and well established. There are many excellent schools of nursing in the United States. Yet there are nowhere near enough nurses to provide good care to all the people even in normal times.

Physical therapy too, is one of the oldest forms of treatment. The most primitive tribes successfully made use of some form of massage, exercise and physical medicine. When the crippled beast licks his wounds he is but applying an elementary form of physical therapy. Yet as a profession and real science the field is relatively new. The technics have moved a long way from the primitive practices. Purely on the merit of the services rendered, the demands for workers in this profession have far outstripped the supply of trained personnel.

War has made tremendous inroads on the inadequate numbers of nurses and physical therapy technicians. The needs of combat troops for the ministering care of these women will increase for as long as there is a war. Nor will the needs of the armed forces be satisfied with declaration of peace. For long years the skills of many thousand persons will be needed to restore comfort and usefulness to maimed and mangled bodies.

There is immediate need for nurses and physical therapists to care for the 1942 crop of poliomyelitis victims. In many cities, towns and villages these cannot be secured. Next year there will be still further call placed upon the depleted ranks. Infantile paralysis cannot be treated without these workers—and today there are not enough of them available.

This problem is not the result of war alone. Long before our entrance into this war the National Foundation realized this need and attempted to give out some assistance. Grants totaling several hundreds of thousands of dollars have been made to schools of nursing and of physical therapy to strengthen and enlarge their teaching staffs; many scholarships have been awarded by the Foundation to deserving students, thereby allowing them to complete their training.

But this is not enough. These schools need something besides teachers and money. They need students. . . . There is no glamour in the business of going to school. There are no parades and bands for those who leave for nursing training schools or colleges giving approved courses in physical therapy. There are no immediate high wage scales for girls in their late 'teens who do this. There is only the prospect of three or four years of hard work and study in preparation for a career of more hard work. But there is more to living than glamour, parades, bands and money.

Poliomyelitis patients with the present day knowledge of treatment have at least a ten to one chance of full recovery from the disease. But recovery can be obtained only with good care. Nurses, physical therapists and then more nurses and more physical therapists must be trained.

If each Chapter of the National Foundation succeeded in inducing but one girl to enter these professions and to *enter now*, there would be several thousands of new professional workers to carry on at least by 1945. Two or even three girls could be recruited from even the most sparsely settled and most remote rural counties. This is a service worthy of consideration. It calls for a different appeal and a different effort. It is neither asking for nor spending money. It is selling an idea that will be of benefit not only to the infantile paralysis patients of the present and future, but will also be of unending value to those who do take up these professional callings as their life's work.

Should information regarding these types of training not be available locally, please communicate with the Foundation. We'll do everything we can to help.

MEDICAL NEWS

Our Editor in Australia

The latest letter from our editorial board member in active war service somewhere in Australia, Capt. Walter M. Solomon, came the new microfilm way and bore the date of July 26th. Its excerpt read as follows: "The work in the physical therapy department continues to increase, we now average 125 patients a day. Today we gave the first treatment with diathermy. As I believe I wrote you the diathermy room must be screened here in Australia and through the good fortune of a chance meeting with an American engineer, a very small room was prepared in record time. It is rather crude; the lumber is second hand odds and ends picked from a wreck, the wiring is not just right but all together it works which is all we care. While the last nail was being driven in we hooked up the machine and got busy. It probably was a bit dramatic but I feel a bit happier. I have three Australian technicians now together with the enlisted men. These Australians are excellent and I feel fortunate in being able to secure their services. I shall miss meeting many of my friends at the forthcoming Congress meeting and would ask you to convey my best wishes to them. It was at these meetings that I met the outstanding men in physical therapy and appreciated the opportunity of learning from them. I hope you will advise me of the various proceedings and of the newer developments."

Grants for Research and Education in Fight Against Infantile Paralysis

Checks totaling $325,844.25 have been forwarded to 26 institutions in various parts of the United States and Canada to carry on virus and after-effects research work and education in the fight against infantile paralysis, according to an announcement made by Basil O'Connor, President of the National Foundation for Infantile Paralysis, Inc.

The National Foundation for Infantile Paralysis, Inc., leads, directs and unifies the fight against infantile paralysis by means of its research, epidemic and educational programs. It also provides medical, nursing and hospital care and orthopedic appliances for needy victims of the disease through its more than 2,400 Chapters.

The funds which make possible the Foundation's programs are raised annually in January during the various celebrations of the President's Birthday.

The grantees and the amount of each grant follow:

The State University of Iowa, College of Medicine, Iowa City, Iowa — $11,200.00.

University of Rochester, School of Medicine and Dentistry, Rochester, New York — $9,200.00.

University of California, Medical School, San Francisco, California — $5,050.00.

The Children's Hospital, Boston, Massachusetts — $4,250.00.

Massachusetts General Hospital, Boston, Massachusetts — $4,200.00.

Michael Reese Hospital, Chicago, Illinois — $3,000.00.

University of Toronto, School of Hygiene, Toronto, Canada — $1,000.00.

N. Y. Society for the Relief of the Ruptured and Crippled, New York, New York — $1,000.00.

University of Southern California, School of Medicine, Department of Anatomy, Los Angeles, California — $890.00.

For Virus Research:

The Johns Hopkins University, Baltimore, Maryland — $59,244.00.

University of Michigan, School of Public Health, Ann Arbor, Michigan — $40,000.00.

University of Minnesota, The Medical School, Minneapolis, Minnesota — $13,255.25.

Michigan Department of Health, Lansing, Michigan — $13,210.00.

University of Wisconsin, Madison, Wisconsin — $12,200.00.

Connaught Laboratories, University of Toronto, Toronto, Canada — $10,860.00.

University of Michigan, Ann Arbor, Michigan — $7,000.00.

University of Chicago, Chicago, Illinois — $6,090.00.

Wayne University, College of Medicine, Detroit, Michigan — $4,700.00.

National Institute of Health, Bethesda, Maryland — $3,500.00.

University of Pennsylvania, Philadelphia, Pennsylvania — $2,500.00.

Harvard Medical School and Surgical Research Laboratory, Boston City Hospital, Boston, Mass. — $1,500.00.

For Education:

Georgia Warm Springs Foundation, Warm Springs, Georgia — $50,120.00.

National Organization for Public Health Nursing, New York, New York — $31,100.00.

National League of Nursing Education, New York, New York — $16,000.00.

Harvard Infantile Paralysis Commission, Boston, Massachusetts — $5,000.00.

Frances Payne Bolton School of Nursing, Western Reserve University, Cleveland, Ohio — $9,775.00.

Marquette University School of Medicine, Milwaukee, Wisconsin — $1,500.00 — to study the relation of nutrition to the morphology and physiology of the Neuromuscular apparatus in skeletal muscles.

Johns Hopkins University Receives Grant From National Foundation

Announcement of a five year, $300,000 grant to the Johns Hopkins University, Baltimore, for an intensive and long time study of the disease of infantile paralysis was made today by Basil O'Connor, President of the National Foundation for Infantile Paralysis.

This is the largest single grant made by the National Foundation since it was organized in 1938. It will be used to establish and conduct the Center for the Study of Infantile Paralysis and Related Viruses at the Hopkins.

In announcing the grant, Mr. O'Connor said: "The establishment of this Center at Johns Hopkins is the product of the ideas of many investigators who, after years of research experience in the field of infantile paralysis, keenly felt the need for a Center in which the talents of numerous scientists with widely diverse backgrounds could be pooled in a concentrated attack upon the problems of the disease. In addition to the separate research work of individuals now supported by the National Foundation in leading institutions throughout the country, there has been a need for units in which all the problems of poliomyelitis could be studied on a comprehensive scale and on a long time basis. The Johns Hopkins University offers an ideal place for such a Center, as a large number of the required staff of epidemiologists, virologists, serologists, neurologists and chemists acquainted with the problems presented by poliomyelitis are available there.

"In view of war conditions it is highly desirable, if it can be accomplished without sacrificing defense interests, to keep a nucleus of scientists at work on the problems of infantile paralysis which are so important to human welfare, with the hope that, when peace is established, contemplated expansion in this field may be rapidly consummated."

Work at the Center will be under the direction of Dr. Kenneth F. Maxcy, Professor of Epidemiology in the School of Hygiene and Public Health. Dr. Maxcy will be assisted by a competent group of scientists, some of whom already have made significant contributions to research in this field.

Three members of this staff already have been appointed and have begun their work, according to Dr. Maxcy. They are Dr. Howard A. Howe and Dr. David Bodian, formerly of the Department of Anatomy in the Johns Hopkins School of Medicine, and Dr. Robert C. Mellors, a young biochemist from Western Reserve University.

The Radioclast Exposed

Since the death of Albert Abrams in 1924, before he had time to hitch himself up to one of his own machines, various commercial promoters have continued to manufacture devices in imitation of those with which he worked. Somehow our federal agencies have not apparently taken the necessary steps to establish that the promotion of such devices constituted fraud and deception. One organization, however, has publicized the fakery involved. In connection with this effort the manager of the Indianapolis Better Business Bureau had a serious investigation made of one such device. This device, known as the "Radioclast," is manufactured and sold by the Electronic Instrument Company of Tiffin, Ohio. The result of this investigation, which was publicized in a recent bulletin of the Better Business Bureau, fully justified the conclusion as to the fraudulent character of the Radioclast. The particular device investigated, known as Model 40, looks like a very expensive radio console 44 inches high, 30 inches long and 18 inches deep. As a matter of fact, "the present price of them is $945.00." On opening the door of the Radioclast, one sees a control panel of highly polished black bakelite on which are symmetrically arranged twenty-four radio type control dials. Contact is made with a person by means of electrodes.

An investigative committee composed of physicians, physicists and engineers opened the apparatus and found that it was made of radio parts, some being especially modified, such as rotary switches. In general the parts were such as can be purchased in any electrical shop carrying radio equipment. The circuit, when traced, revealed an astonishing hook-up. Quoting from the Indianapolis Better Business Bureau Bulletin: "The device has been branded as a fake and a fraud by competent scientists who have examined it." "The Manager of the BETTER BUSINESS BUREAU, in a public affidavit before the Indiana State Board of Medical Registration and Examination, branded the use of this device in the diagnosis and treatment of serious diseases as a fraudulent practice, and asked the revocation of the licenses of certain 'doctors.'" The conclusion of the investigating committee appointed to examine and report on the Radioclast, Model 40, is:

The Committee has made a careful scientific examination of the aforementioned apparatus and concludes that this Radioclast is totally incapable of accomplishing what is claimed for it as a diagnostic device, and the use of the device would not constitute competent scientific treatment for any disease that may be present. — [Reprinted with permission J. A. M. A. **119**:953 (July 18) 1942.]

The Unconquered People

Only the ignoble, the shameful, and the base can be suppressed — never the heroic truth. Men everywhere, of whatever race, despise themselves when they are ignoble and they do not talk about it. Men everywhere are proud of the heroism of their fellow men and will tell of it, even though they die in the telling.

And so on the winds of freedom, those winds which never cease to blow are borne today the stories of heroism in the conquered countries. Conquered? The stories which the winds of freedom bear prove once again that free men cannot be conquered. The treachery and the armed might of tyranny may crush them for a time, but those who live will speak out and speak out

again until freedom is restored. Thus come the voices from the countries which the Axis has sought to enslave:

They reach the United Nations, which must fight to free them, through smuggled letters.

Men and women who have escaped tell of the fight which does not cease.

Short-wave broadcasts from secret stations, operated under penalty of torture and death, pierce the mysterious ether until they are heard by alert listeners.

Underground newspapers pass from hand to hand until they reach a free border.

Agents of the governments-in-exile obtain confidential reports which they release to an anxiously waiting world.

But these are not the only ways in which the world learns that Norway does not falter, that Holland is not crushed, that men still walk erect in Belgium, in Occupied France, in Czechoslovakia, Greece, and Poland, among the brave Yugoslavs — that everywhere the "New Order" is scorned and being undermined. The story is revealed, too, by the Quislings and other hirelings of the "New Order." The hirelings, from time to time, publish in their controlled journals new orders against sabotage and new decrees against resistance. They must impose new penalties and new tortures upon the men and women who will not stop their struggle for freedom and who continue, somehow, to tell their brave story.

(Taken from the pamphlet "The Unconquered People." Additional copies may be obtained by writing the Office of War Information, Washington, D. C.)

Enemas of Sea Water Unsuccessful for Quenching Thirst

In the *South African Medical Journal* (March 28, p. 113), Foy, Altmann and Kondi report experiments on 6 healthy persons who were deprived of all fluid for about eighty hours, 3 receiving rectal injections of sea water and 3 acting as controls. The only food was dry ship biscuits, which were hardly taken at all after the first day, and lime flavored sweets, called "life savers." A daily total quantity of 1,500 cc. of sea water in five or six doses was aimed at, but this quantity could not be retained. The maximum in the first twenty-four hours was 1,300 cc., and 2 of the 3 persons actually returned from 150 to 200 cc. more fluid from the rectum than they received. Thereafter four daily doses of 200 cc. were given, but even this quantity was retained with the greatest effort.

There was no difference clinically between the two groups. All had decreasing pulse rates and a tendency to lowered blood pressure. The signs of dehydration (dry mouth, sunken eyes, inelastic skin) were equal in the two groups, as was the sensation of thirst. All said that sucking the sweets helped to overcome the dryness of the mouth and so alleviated the thirst. On the last day of the experiment, 2 of those taking the sea water complained of severe lumbar pains. The hemoconcentration produced by dehydration was practically the same in the two groups, but those receiving sea water had higher values for blood chlorides; also their urinary output, urinary concentration and total excretion of chlorides were much the higher. There was evidently enforced tissue dehydration, which was confirmed by an average loss in weight per person of 10 pounds against 6 pounds in the controls. The conclusion was that sea water, though absorbed, is of little or no value in maintaining the water balance and possibly is harmful.

Volunteers in Child Care

For the use of Civilian Defense Volunteer offices, Children's Health and Social Welfare Agencies and other community services and for persons interested in volunteer participation in child care programs, the Office of Civilian Defense with the cooperation of the Children's Bureau, Department of Labor and the Office of Defense Health and Welfare Services has prepared a pamphlet "Volunteers in Child Care." In this 17 page paper booklet it is pointed out that there is an urgent need for volunteers in the field of child care and suggested steps are given that might be taken in a local community in the organization of a volunteer program in child care.

Employment of Handicapped Workers

Many thousands of persons with minor or major disabilities will receive employment in the war industries if employers follow the suggestions for their employment as a result of conferences held by the U. S. Office of Education, the U. S. Employment Service and the Division of Industrial Hygiene. This would require revision where necessary of existing physical standards for employment.

Caucasian Mineral Baths

While the region of the Caucasus is in the center of the war news it is interesting to note that this region is famous for its mineral baths. Pyatigorsk is known for its sulphur baths, and others for treatment of gastric ulcers. Most famous is Kislovodsk, chiefly for alleviation of heart disease. Mineral waters of the various resorts are also popular table beverages in the Soviet Union. Narzan, the Kislovodsk water, was exported in large quantities before the present war. Warm springs of this region owe their existence to the once volcanic nature of near-by Elbrus. A mineral spring here yields more than 625,000 gallons of carbonated water every twenty-four hours. Sanatoriums line the terraced hillside park of Pyatigorsk in the northern Caucasus. From Tambukan Lake come radioactive waters and medicinal mud. Closely grouped in this area are 17 mountains of volcanic origin, giving rise to mineral springs. — (*National Geographic Magazine*, July, 1942.)

BOOK REVIEWS

HEALTH EDUCATION OF THE PUBLIC. A PRACTICAL MANUAL OF TECHNIC. By *W. W. Bauer*, B.S., M.D., Director, Bureau of Health Education, American Medical Association, Chicago, and *Thomas G. Hull*, Ph.D., Director, Scientific Exhibit, American Medical Association. Second Edition. Cloth. Price, $2.75. Pp. 315 with 52 illustrations. Philadelphia and London: W. B. Saunders Company, 1942.

Dr. Fishbein in his foreword calls attention to the "Principles of Medical Ethics" of the American Medical Association which contains one section devoted to the duties of the medical profession to the public. It begins: "Physicians, as good citizens and because their professional training specially qualifies them to render this service, should give advice concerning the public health of the community. They should bear their full part in enforcing its laws and sustaining the institutions that advance the interests of humanity. They should cooperate especially with the proper authorities in the administration of sanitary laws and regulations. They should be ready to counsel the public on subjects relating to sanitary police, public hygiene and legal medicine."

The medical profession has taken this obligation most seriously. Bauer and Hull have written a book that will prove particularly helpful in organizing and conducting the many branches of an effective health education program. This book gives many valuable hints on the use by physicians of the radio, motion pictures and stereopticon slides. It presents the best methods for presenting exhibits and writing newspaper and magazine articles.

These authors have had a tremendous experience in this field as they have been directors of the bureaus of the American Medical Association intimately associated with the fields of health education and scientific exhibits. Every physician should read this book.

PSYCHIATRY IN MEDICAL EDUCATION. By *Franklin G. Ebaugh*, M.D., and *Charles A. Rymer*, M.D. Cloth. Pp. 606. Price, $3.50. New York: The Commonwealth Fund, 1942.

The field of psychiatry has expanded tremendously in the past two decades. It may be said that its growth has been directly in proportion to the recognition by the entire medical profession of the important roles played by mental attitudes and emotional disturbances in all illnesses, including the more strictly somatic forms.

This book offers an up-to-date compilation of present attitudes of medical educators on the basis of reference to actual statements of the men concerned. The questionnaire method has been used by the authors to obtain specific information of the various institutions, a method which serves to point out the recognized defects in present methods of teaching as well as to emphasize the value placed on psychiatry in medical education. As might be supposed, the urgent need for more psychiatric education has imposed many problems of curriculum upon medical schools, and these problems have been met with varying responses, ranging from a marked increase in psychiatric teaching hours to a relatively indifferent relegation of psychiatry to the field of graduate medicine.

Although this book presents the most complete analysis of the present status of psychiatric education by its use of statistical and completely authoritative material, it is by no means a colorless statistical monograph. The chapter on psychobiology is the most clearly presented treatise of this important concept that the reviewer has found in any psychiatric literature. In addition, the appendices offer specific methods of eliciting the pertinent facts of personality analysis, of mental status and the patient's history which can profitably be employed by the practicing physician to review such technics for his own practical application. The appeal of this book would seem to be largely limited to medical faculties and individual physicians who have a sincere interest in the furtherance of psychiatric education as a means of adequately treating the vast army of patients who have psychiatric disturbances, but the fact should not be overlooked that this book is an excellent guide (for example, in chapter 10) for the prospective graduate student in psychiatry by its specific listing of the various plans of training offered by representative hospitals.

There are probably few practicing physicians who will read this book in detail, but there are far fewer physicians who cannot derive practical benefit to themselves and their patients by a substantial acquaintance with its contents.

THE ADVANCING FRONT OF MEDICINE. By *George W. Gray*. Cloth. Pp. 297. Price, $3.00. New York: Whittlesey House, McGraw-Hill Book Company, Inc., 1941.

The purpose of this book can be given by using the words of the author. "This book is not a compendium of medical lore, or a guide to modern research, or a treatise on cures. It is simply an effort to convey an impression of what medicine is trying to do, of the standards and procedures with which it works, and of the achievements, the problems, that are engaging the attention of the men of the laboratories and those in the clinics."

Obviously, the field of medicine is so large that the subjects the author chose to discuss had to be limited. He therefore selected "representative problems of present-day medicine" which would seem to be of most interest to the person who wishes to know

what is being done in behalf of his health and longevity.

An attempt has been made to present material which is least controversial and has had some substantiation by research. The author makes it clear that there are only a few subjects discussed in which full knowledge has been attained. There is a short discussion of the development of the modern concept of disease and advancement in knowledge, particularly of infectious diseases, endocrine disturbances and nutritional deficiency. There are discussions of the history of the development and current concepts of nutrition, deficiency diseases, abnormalities of the blood, high blood pressure, sulfanilamide, influenza, allergy, anxiety, "brain storms," pain, smoke, drink and the aging process. Many of the sources from which the author has obtained his knowledge are cited, and the names of the men who have been responsible for the advancement and the research are given.

The book is interestingly written and contains none of the usual spectacular elements and near-untruthful interpretations given by many lay writers on medical subjects. The author indicates that he has a good insight into the medical sciences and the problems of medicine. The book is written with as few complex technical terms as it would seem possible to employ in a book on a highly technical field. Yet it is not so simply written that it is uninteresting to the person trained in the sciences concerned. The book probably will not be of interest to the person who likes light reading primarily. It should be extremely interesting to those of the public who like informative books. The book also will be of interest to many physicians and men of the allied sciences, from a historical standpoint as well as for its value as a general brief review of the subjects discussed.

VASCULAR SCLEROSIS. WITH SPECIAL REFERENCE TO ARTERIOSCLEROSIS. PATHOLOGY, PATHOGENESIS, ETIOLOGY, DIAGNOSIS, PROGNOSIS AND TREATMENT. By *Eli Moschcowitz*, A.B., M.D. Cloth. Pp. 192, 43 Illustrations. Price, $3.75. New York: Oxford University Press, 1942.

This excellent monograph treats the subject of arteriosclerosis from the viewpoint both of the pathologist and of the clinician. Throughout the book the author expands the thesis that hypertension preceeds rather than follows pathologic changes in the entire vascular system. By giving his own extensive experience at the bedside and at the autopsy table, he is able to simplify the subject matter so that it is of much practical value to a better understanding of the various viewpoints that have appeared from time to time in the current literature. He states that intravascular pressure is primary and that secondary, or conditioning factors are (1) the chemical composition of the blood, (2) the vascular supply of the blood vessel walls, (3) intravascular stresses and (4) perivascular resistance. He brings the subject up to date with an excellent discussion of Goldblatt's work on experimental hypertension in animals.

As in all such monographs, the reader can find many statements that are open to criticism. For instance, the author states that neurocirculatory asthenia is clinically the earliest phase of Grave's syndrome. The writer takes issue with this assertion. However, the presence of a few rather dogmatic statements should not detract from the general excellence of this book. The format of the book—always excellent in Oxford publications—the fine reproductions of photomicrographs, the selection of subject matter for each chapter and, finally, the clarity of expression are all commendable. This monograph on hypertension is worthy of a place in the library of every practicing physician.

HELP YOUR DOCTOR TO HELP YOU WHEN YOU HAVE CONSTIPATION. Pp. 59. HELP YOUR DOCTOR TO HELP YOU WHEN YOU HAVE INSOMNIA. Pp. 29. HELP YOUR DOCTOR TO HELP YOU WHEN YOU HAVE HEART DISEASE. Pp. 47. 2 illustrations. HELP YOUR DOCTOR TO HELP YOU WHEN YOU HAVE HIGH BLOOD PRESSURE. Pp. 25. By an Editorial Board consisting of *Walter C. Alvarez*, M.D., Editor-in-Chief; *George Blumer*, M.D.; *Logan Clendening*, M.D.; *Irving Cutter*, M.D.; *Howard W. Haggard*, M.D.; *Rudolph Matas*, M.D.; *Charles W. Mayo*, M.D.; *George R. Minot*, M.D.; *John H. Stokes*, M.D.; *George H. Whipple*, M.D. In four individual volumes. Price, 95c per volume. New York and London: Harper & Brothers, 1941.

These are four additional booklets in the series of popular monographs the general idea of which has been described and commented on in an earlier review. The little volume on constipation discusses in popular language the causes of this complaint and the symptoms to which it may give rise and then explains what can be done for constipation and evaluates the various types of treatments. In discussing these in a common-sense way, the author is quite outspoken about some of the common notions of patients as well as some physicians who are all too prone to treat all cases of constipation the same way. The volume on heart disease is written in an especially sensible way. In its introduction it first endeavors to allay some of the groundless fears about a heart condition, by describing the symptoms which are so often erroneously attributed to disturbances of the normal heart. After explaining the methods of diagnosis, there is described the different kinds of heart disease and their treatment. A brief discussion of habits ends this volume. The booklets on high blood pressure and insomnia are written in a similar vein, avoiding complicated descriptions and presenting the essentials of each problem in simple language. The lay person of average intelligence whose mind has not been warped by the ballyhoo of a cult or the exaggerations of some charlatan, should profit greatly by this supplement to the instructions of his physician. These volumes may also serve as a useful model to some physicians to learn to speak a language that the average lay person can understand.

PHYSICAL THERAPY ABSTRACTS

The Inadequacy of a Single Prolonged Fever for the Treatment of Early Acute Syphilis. Ruth A. Boak; Charles M. Carpenter; Nathaniel Jones; Rudolph H. Kampmeier; William S. McCann; Stafford L. Warren, and John R. Williams.

Am. J. Syph., Gonor. & Ven. Dis. **26**:291 (May) 1942.

Although the immediate effects of a single prolonged induced fever are dramatic and most of the spirochetes are apparently destroyed, some must remain to cause the subsequent relapses. Since fever therapy destroys most of the organisms and since no known drug is spirocheticidal, the possibility is still open that fever therapy may have a place in the treatment of acute syphilis in conjunction with other therapy because of its marked spirocheticidal properties.

Why fever therapy fails to destroy all the spirochetes may possibly be explained by some of the spirochetes being distributed in parts of the body that do not rise in temperature to spirocheticidal levels during all or part of the febrile period. Careful measurements show that the skin over the face and trunk may have temperatures varying from 0.5 C. to 3.0 C. below the rectal temperature even with high surrounding temperatures and that the mucous membranes of the lips, throat, nose and apparently the vulva also may have temperatures from 1.0 C. to 3.0 C. below the rectal temperature during the febrile state. Mouth temperature measurements made with a thermometer frequently show only 0.2 C. to 1.0 C. decline because of the restoration of higher temperatures when the mouth is closed. With the mouth open, the evaporation of moisture rapidly cools the surface in which the spirochetes may be residing. Thus certain collections of spirochetes may be subjected to swings of temperature, the cumulative effects of which are not totally spirocheticidal even though the Treponema pallidum may disappear from the dark-field preparations.

A single prolonged fever treatment (ten to fifteen hours at 41.0 C. to 41.5 C.) resulted in a prompt resolution of the lesions in a series of 8 cases of primary and secondary syphilis. These lesions usually became dark-field negative during the single period of actual treatment. In general, such patients show as much improvement within two or three days after fever therapy as patients with similar lesions may display in two weeks under ordinary chemotherapy. No appreciable effect upon the quantitative Wassermann reaction was noted.

Four of 5 patients who did not receive subsequent chemotherapy within four months developed mucocutaneous relapses. The fifth patient retained a positive Wassermann reaction but apparently had no relapse. The 3 other patients were given routine chemotherapy within two weeks after the administration of fever therapy.

The febrile state (41.0 C. to 41.5 C.) destroys large numbers of treponema pallidum, yet enough survive in the cooler parts of the body to cause relapses. The spirocheticidal action of the febrile state may prove to be of value when used concurrently with chemotherapy.

A New Bipolar Spot Coagulating Electrode for Neuro and General Surgery. Mark Albert Glaser.

West. J. Surg. **50**:171 (March) 1942.

The use of a coagulating electrode has expedited the performance of neurosurgic procedures because the blood vessels situated deeply in the soft brain can readily be coagulated. This method replaces the use of silk ties or silver clips in certain instances.

The present technic consists of touching a hemostat or a pair of forceps with the end of a unipolar coagulating electrode.

By the use of the bipolar electrode the coagulation is limited to the spot between the two points of contact.

Properties of Human Skin Revealed by Fluorescence Microscopy. The Normal Skin; The Vitamin A Content of the Skin. Theodore Cornbleet and Hans Popper.

Arch. Dermat. & Syph. **46**:59 (July) 1942.

The idea of examining the skin and its appendages and pathogenic fungi under ultraviolet rays and for their fluorescent properties is well known. Skin and epidermal appendages impart a characteristic fluorescence, as do fungous infections of the scalp. The microscopic examination of the skin under ultraviolet rays has only rarely been employed. The interest of the authors in examining the skin under the fluorescence microscope was to find new diagnostic possibilities in the histologic study of the skin. Not only the spontaneous fluorescence but also some staining reactions with fluorescent dyes were studied.

The characteristic, quickly fading green fluorescence of Vitamin A is useful for detecting its presence. Previous studies have revealed that no vitamin A fluorescence can be found in the skin and that the presence of Vitamin A in the adjacent fat tissue only is responsible for the small amounts of this vitamin found in chemical assays of the skin. The cited studies on Vitamin A fluorescence have shown that the fluorescent properties of the tissue undergo remarkable changes if kept in fixatives for a long time. Therefore only fresh sections of material, pre-

served not longer than twenty-four hours, were examined in order to correct some of the older reports of fluorescence microscopic examinations in which these precautions had not been taken.

The other lipids of the skin are free of Vitamin A. The feeding of large amounts of Vitamin A does not produce storage of Vitamin A in the epidermis. This is the more interesting since the epidermis is one of the first sites of the body to react to a deficiency of Vitamin A. Some persons think that the pathologic changes of the skin with hyperkeratinization are the first clinical signs of Vitamin A deficiency. Since Vitamin A is absent from the epidermis it appears that the influence of its metabolism on the skin must be mediated from some other site. The reduced storage of Vitamin A somewhere else (liver?) in vitamin A deficiency or its reduced metabolism may be the cause of the changes found in the skin. Previous studies on human material and experimental animals showed that epithelium from other organs, such as the bronchi, gastrointestinal tract or urinary tract, is similar to that of the skin in that it is lacking in fluorescent properties and is sensitive to Vitamin A metabolism.

Iontophoresis of Copper Sulfate for Mycotic Infection. A. M. Greenwood and Ethel M. Rockwood.

Arch. Dermat. & Syph. **44**:800 (Nov.) 1941.

Greenwood and Rockwood say that for their 4 patients from whom material which produced cultures of identifiable fungous organisms was obtained from affected areas at their first visit the introduction of copper sulfate into the skin by iontophoresis was neither fungicidal nor fungistatic for the three pathogens found: Trichophyton gypseum, Trichophyton purpureum and Epidermophyton inguinale. When clinical improvement follows such treatment it must be due to some factor or factors other than the copper sulfate. One of the patients was given twenty-five treatments, and still it was possible to grow T. gypseum from scales taken at each examination and at the patient's last visit. In another patient the process was extending so rapidly after the sixth iontophoresis that compound ointment of benzoic acid was applied for ten days, and since then there has been no obvious activity and all scales and cultures have been negative for T. gypseum. The third patient was treated for a month, and culture for E. inguinale was positive after each treatment. After treatment with compound ointment of benzoic acid the condition was clinically improved but still active mycologically for E. inguinale. The fourth patient was treated with copper sulfate iontophoresis for thirty-three days, and culture of material obtained during and at the conclusion of treatment showed T. purpureum. — (Abstr. J. A. M. A. **118**:80 [Jan. 3] 1942.)

Adynamic Ileus and Thermal Influences on Gastric and Intestinal Motor Activity. J. Dewey Bisgard; Guy M. Matson, and Jerome Hirschmann.

J. A. M. A. **118**:447 (Feb. 7) 1942.

A detailed account of the influence of hot and cold applications on gastric and intestinal motor activity and on the secretion of hydrochloric acid was made in a previous communication. A brief summary of these data follows. After establishing for each patient studied reasonably normal tracings from balloons indwelling the stomach and the small and the large bowel the following influences were brought to bear at successive periods of observation: (1) The abdominal wall was completely covered with hot water bottles for thirty minutes, (2) the abdominal wall was covered with ice bags for thirty minutes, (3) both thighs were covered with hot water bottles for thirty minutes, (4) both thighs were covered with ice bags for thirty minutes, (5) hot water was administered orally and (6) ice water was administered orally. During the period of recording the motor activity of the stomach, samples of the gastric content were aspirated and analyzed for acidity.

Complete series of records were obtained of responses of the stomach in 8 patients, of the small bowel in 6 and of the colon in 4. The responses were sufficiently consistent to be reported collectively as typical of the organ and the experimental factor. Heat applied to the abdominal wall inhibited motor activity of the stomach, the small bowel and the colon. Conversely, cold stimulated tonus and peristaltic activity. When heat or cold was applied directly to the wall of the stomach by having the patient drink hot or cold water the responses were reversed. Heat stimulated and cold had a slightly inhibiting effect on both gastric and intestinal motor activity. Hot applications on the thighs had no effect, and cold ones influenced only the stomach, producing a moderate motor response. Cold applications on both abdominal wall and thighs caused a big increase in both free and total hydrochloric acid.

From the physiologic data mentioned there may be obtained some guidance for the proper clinical uses of hot and cold applications. If it is beneficial, as is generally believed, to inhibit the motor activity of the gastrointestinal tract and thereby place it at rest as far as possible in the presence of inflammatory lesions such as appendicitis and peritonitis, and of bleeding lesions, such as bleeding peptic ulcer, then hot applications and not ice bags are indicated. In the case of peptic ulcer the increase in gastric acidity following cold applications to the abdominal wall also is undesirable.

During the past two years we have lavaged the stomach with ice water in 4 cases of actively bleeding ulcer. Either because of or in spite of this therapy the bleeding promptly ceased in 3 cases. Theoretically, direct chilling of the wall of the stomach should produce vasoconstriction

(of bleeding vessels) in addition to lowering acidity and inhibiting motor activity.

The increase in gastric acidity which follows chilling of the body surface may explain the recurrence of peptic ulcer in the fall and the spring, when there are rapid and radical changes in temperature.

Throughout this discussion the term motor activity has been used and the term motility avoided. The records measured only peristaltic activity and tonus. Motility refers to the movement of gastric and intestinal contents, and this is dependent not only on peristalsis but on the patancy of the sphincters and on coordinated activity between adjacent segments of the stomach or the bowel. Peristalsis is ineffectual when disorganized. In the normal process of both segmental and mass movements of intestinal contents the various segments of the bowel contract and relax alternately in well integrated fashion. As a given segment contracts and expels its contents the adjoining distal segment relaxes to receive it. Failure of this distal segment to relax not only interferes with the normal movement of intestinal contents but gives rise to cramplike pain, such as colic and gas pain. Hot applications are more effective than cold ones in relieving gastrointestinal cramps, because their inhibiting effect relaxes spasm and thereby facilitates coordinated activity.

In regard to the first fluids taken by mouth by patients after operation, we have observed no difference in the response to cool and to warm fluids except that cool ones are more palatable. Ice water, however, is definitely less well tolerated.

A Combined Epilation Needle and Forceps Handle. H. C. Goldberg.

Arch. Dermat. & Syph. **44**:1104 (Dec.) 1941.

A simple and efficient instrument combines the epilation needle and forceps on one handle. The forceps is readily attached to the handle of the epilation needle by two ordinary rubber bands, by transparent tape or by more permanent means if desired. With this arrangement, one hand is used to stretch the skin prior to the insertion of the needle. The other hand inserts the needle into the hair follicle in the prepared area of skin. A deft turn of the instrument after the treatment of the hair is completed enables the operator to grasp the hair and remove it with the forceps. This area of skin is still in position, ready for the next insertion of the needle.

Brain Metabolism, VIII. The Effects of Electric Shock and Some Newer Drugs. S. Bernard Wortis; Donald Shaskan; David Impastato, and Renato Almansi.

Am. J. Psychiat **98**:354 (Nov.) 1941.

Electrical convulsions inhibit oxygen uptake; this effect is greater after repeated shocks and is more marked in the dextrose substrate.

Electrical convulsions and to a greater extent, insulin, interfere with oxygen uptake, in contrast to metrazol and camphor which are metabolic stimulants. The availability or utilizability of dextrose by the brain may account for this difference.

Management of Endocervicitis. T. K. Brown.

Wisconsin M. J. **41**:117 (Feb.) 1942.

Hyams described a technic of conization of the cervix in which a very small amount of tissue was removed from the cervical canal. R. J. Crossen modified the Hyams electrode so that it was in the shape of a number four and recommended its use for the removal of a cone-shaped portion of the cervix. This should be a hospital procedure. By extending the treatment, the cervix may be reduced almost to the extent of amputation. Conization can readily be used in the care of endocervicitis in the cervix remaining after supravaginal hysterectomy.

The Crossen electrode had a porcelain stem which was readily broken by the novice and could not be repaired. The author modified the construction of the electrode so that it has a nonbreakable metal core covered by lucite as an insulator. Should the wire be broken it could be replaced by threading a new nichrome wire of desired size through the electrode and tightening a set screw which fixes both ends of the wire. The size of the loop may also be adjusted to that desired by the operator. These electrodes have seen service for several months at a time before requiring attention and can even be dropped without breaking.

The author believes in the removal of diseased cervical tissue by conization and the control of bleeding points by coagulation with a small ball-shaped electrode. Sutures are only occasionally required to control bleeding and this is usually in a case of marked inflammatory reaction with blood vessels of unusual calibre being encountered. Crossen and Wulff have well described the use of sutures in such cases. Use extreme caution to be sure that the indifferent electrode is making proper contact with the patient so that the danger of a burn may be avoided. Each high frequency machine used must be desired. The loop must not cut too quickly or bleeding may result, or too slowly or coagulation will be excessive.

The time of surgical treatment of the cervix is important. The optimum time is during the week after the menses cease or about mid cycle. Healing may be quite well advanced before the next menses.

Troublesome Skin Diseases in Infancy and Childhood. Arthur R. Birt.

Canad. M. A. J. **46**:132 (Feb.) 1942.

Tinea capitis presents a constant challenge to those treating skin diseases of childhood. It is caused by invasion of the hairs of the scalp by fungi. The diagnosis is based on (1) clinical examination; (2) the fluorescence of infected hairs

when examined in a darkened room with filtered ultraviolet light (Woods' light); and (3) the microscopic examination of hairs. The actual species of fungus present can only be determined by making cultures on Sabouraud's standard media. The importance of this has not been generally recognized. The prognosis and treatment in tinea capitis depend entirely on the type of fungus causing the infection. Ringworm of the scalp found in this part of Canada is caused by (1) the microsporons, and (2) the trichophytons. On culture the microsporons found are M. audouini and M. lanosum. The species of trichophyton found here are T. album and T. gypseum. In 1932, while working with Davidson and Gregory, we found that it was possible to tell the type of fungus causing the infection, by the clinical appearance of the scalp.

Co-ordination of Physical Methods in the Treatment of Peripheral Nerve Injuries. F. S. Cooksey.

Brit. J. Phys. Med. 5:25 (Feb.) 1942.

The reactionary edema in a limb after trauma is the first and most potent cause of atrophy of the muscle and of stiffness of the joint. When the vasomotor, sensory and motor nerves are divided, the harmful effects of edema are greatly increased. The extreme muscle atrophy and intractably stiff joints which are seen in spite of months of massage, electrical treatment and passive or assisted movements, are due to failure of early treatment. Joints of a paralyzed limb should be moved as early as possible; but movements once or twice a day are not sufficient in all cases to prevent stiffness when edema is present. It is of primary importance, therefore, that reactionary edema should be prevented as far as possible or effectively controlled as soon as established. This is achieved by posture, supports such as plaster of paris or elastic webbing bandages and massage. Postural drainage by elevation of the injured limb is the most effective. Certain elastic bandages are most effective, especially if reapplied after massage twice a day. Massage is a well-recognized means of reducing edema; but it is useless unless the limb is elevated or supported by an elastic bandage between treatments. If a concurrent fracture makes the use of plaster of paris essential, then elevation of the limb in the splint and movements of all joints which are not included in the plaster are all that is necessary; but when plaster is not used the combination of posture, massage, elastic bandages and movements of all joints should be employed until the edema is under control.

The ultimate result of peripheral nerve injuries is often determined by the excellence or otherwise of the surgical care applied within a few hours of the injury, and coordination of physical methods with the surgical treatment should start at that time. A nerve suture, however skillfully performed, or months of physical treatment will not restore function to fibrotic muscles or movement to joints which are the seat of diffuse capsular fibrosis.

Standardization of the Treatment of Arthritics. Ralph Pemberton.

Practitioner **148**:164 (March) 1942.

The first recommendation which should be made in the direction of care of any given group of arthritics should be rest, not only local but systemic.

A diet may be planned which makes towards or away from a tendency to tissue edema and in the practical treatment of arthritics this is sometimes a measure of not inconsiderable importance. It can be carried out without detriment of any kind to the patient and the quota of calories may be as liberal as desired. It is worth noting, incidentally, that during conditions of under-nutrition, water is eliminated because of the necessary breakdown of glycogen and fat and under such conditions even an exclusively liquid diet, with no restriction of the water intake, will nevertheless bring about loss of tissue fluid.

Physical therapy plays an important adjuvant role. However, even in well reputed spas, emphasis on this measure may be unduly great and many instances are to be seen in which the principle of rest has been violated, Ossa has been piled on Pelion, and faulty and painful joints have been injured by what was, in fact, further trauma.

In order to bring to a focus, however inadequately, the general point of view outlined above, there is herewith appended a sequence of steps which, in my opinion and that of my associates, should underlie any large-scale attempt at the treatment of arthritics as a group.

1. Rest, systemic as well as local.
2. Sedation and/or stimulation.
3. Optimal nutrition in the refined sense earlier discussed.
4. Proper gastro-intestinal function.
5. Examination of the blood and body chemistry.
6. Time for establishment of a general equilibrium.
7. Examination for foci of infection.
8. Medication, such as iron, arsenic, nux vomica.
9. Treatment of foci, conservatively.
10. Use of physical therapy, conservatively — meaning chiefly heat, gentle massage, postural exercise.
11. Orthopedic help.
12. Endocrine therapy in selected cases.
13. Psychological re-education.
14. Lastly, if at all, vaccines, or gold.

The Various Forms of Shock Therapy in Mental Disorders and Their Practical Importance. Lothar B. Kalinowsky.

New York State J. Med. **41**:2210 (Nov. 15) 1941.

The practical value of the various forms of shock treatment cannot be doubted. What is the best possible way to utilize the new methods? It has to be admitted that most physicians have no idea how these treatments act and that "we treat an unknown disease by unknown means" (Frostig). These methods break up a psychosis and rapport with the world is reestablished. It is not known how this occurs, but it is seen empirically

that results are obtained. The only practical conclusion, therefore, is to treat the patients with one or another of these methods. A certain reluctance is felt in many places—a fact that one gathers not from literature but from personal contact with people. Disappointments give no right to give up. The most consistent argument one hears is the occurrence of relapses; if this were an argument against treatment, no cancer therapy would exist. Our chances are certainly better than in cancer, because relapsed psychotic patients offer a good prognosis on retreatment. It should not be forgotten that every day outside a mental institution is a gain of life for the person and his family and a financial gain for the community.

Treatment of large groups of patients will increase our experiences. At this time and for several years to come it will be a moot question to ask whether insulin or metrazol or electric shock is the best treatment. The best results will be achieved by a combination of the different methods in different ways. The various methods are not meant to compete but to complete each other.

Subconvulsive Reaction to Electric Shock. C. Watkins; E. J. Stainbrook and H. Lowenbach.

Psychiatric Quart. **15**:724.

Watkins and his associates point out that a volunteer, a physician of 25, was submitted to an electric subconvulsive shock. His behavior and experience during recovery were similar to those observed in patients with mental disease after convulsive shocks. The principal features of the volunteer's behavior were absence of somatic and mental complaints, amnesia and disorientation. — (Abst. J. A. M. A. **118**:85 [January 3] 1942.)

Management of Burns in Children. H. Jerry Lavender.

J. A. M. A. **118**:344 (Jan. 31) 1942.

The author discusses the comparative results of the following methods: The use of crust formers or coagulants, the use of wet dressings with antiseptic solutions, the compression or closed method and the tubbing procedure. No case is included in which less than 10 per cent of the skin area was involved.

The tubbing procedure should be classified as a combined method. It has been described in detail in a previous publication.

This method has several advantages. The water bath is well tolerated, the wounds and especially the sloughing areas are kept cleaner, relaxation from muscle tension and spasm is afforded after a few minutes and mild exercises of the involved members may be encouraged and started earlier. Contractures may be prevented in the majority of cases, and by not interfering with the granulation tissue the wounds heal rather rapidly or are prepared earlier for grafting. Here again, in an extreme or extensive case, or one of borderline involvement, after the original cleansing bath and debridement the patient may remain in bed for two or three days before the tubbing procedure is instituted, the wet dressing method being enforced in the interim.

The tubbing method is indicated when the trunk is involved, and especially the genitalia, or when a combination of the trunk and other areas are involved. It is an ideal method when the hands or feet are involved, and at this point I wish to emphasize the use of the continuous water bath when the hands or feet alone are burned. With specially constructed metal fixtures in the form of boots for the feet and long troughs for the forearms and hands, the involved members are submerged for hours at a time, resort being made to wet dressings between dippings. I have observed 2 cases in which, with the water bath alone, spontaneous amputation of one or more toes occurred after a deep burn of the foot in which gangrene had developed.

The aqueous solution of soft soap, if properly made, is nonirritating, and at no time have I encountered a dermatitis or irritation directly attributed to the soap.

The author makes the following general comment: It is of prime importance to resort to systemic or supportive therapy before any form of local approach is considered, and the supportive treatment must be maintained throughout the local management. Burns caused by fire are of greater intensity and usually manifest themselves as third degree involvement. They require greater care and longer hospitalization than scalds, irrespective of the type of local therapy. According to age grouping, infants 1 year and under have the shortest convalescent period, owing to the fact that the majority of injuries are by scalding. Children 2 to 4 years of age present the most serious problems and have the longest hospitalization period. According to location, cases in which there is involvement of the leg require the longest convalescent period. The greater the lapse in time before proper local therapy is instituted the greater the number of infected wounds and the greater the stay in the hospital. "Home remedies" also are a detriment. Debridements should be thorough and complete, aseptic technic being used in all cases.

Sloughing of the deep and devitalized burned tissue is part of the natural body defense and cannot be prevented, no matter what type of local therapy is instituted. In spite of condemnation by many workers, wet dressings have their place in therapy for burns; likewise the crust formers, the tubbing method and the compression procedure. Combinations of the methods may and should be used to enhance the desired end result. Secondary infection and irregular sloughing play important roles in causing hypertrophic tissue and keloid formation. Secondary pyogenic infection heads the list of complications, while acute infection of the upper respiratory tract is second. Spontaneous healing should be permitted and encouraged before resort is had to grafting. In a series of 250 burned infants and children, every one survived who lived to the tenth day. There were 14 (5.6 per cent) deaths, with pneumonia topping the list of contributory causes.

Rehabilitation and the War. F. D. Howitt.

Brit. J. Phys. Med. & Indust. Hygiene 5:81 (May-June) 1942.

The use of physical therapy comprises massage and movements, and the application of certain physical agents such as heat, light, electricity and baths. A physical therapy technician is qualified, but not medically qualified, to carry out such treatments. Their training, which is thorough, includes a groundwork of anatomy and physiology, in addition to technical instruction in the physical properties of apparatus and the reactions which these produce. Needless to say, any physician can prescribe these treatments, but owing to an unfortunate blank in the medical curriculum, he is often unable to do so. The war has emphasized the need for the training of hospital medical students in the technic of physical therapy and it is to be hoped that greater provision will be made for this in the syllabus of the future. Such training should include instruction in the essential indications and contraindications of active and passive movements, the physiologic effects of long and short actinic rays, the penetrative effect of heat applied by conduction, radiation or short-wave therapy and the uses and abuses of galvanism and faradism.

Profiting by the experience of the war of 1914-18, Germany, America and Canada instituted occupational therapy departments in all their major hospitals. Unfortunately, the value of occupational therapy was appreciated by very few in Great Britain, with the result that the present war found us not only with an ignorance of the subject, but also with a great scarcity of trained occupational therapists. This defect is now being remedied with such fervor that there is a danger of loss of perspective in relation to other physical methods.

The subject of rehabilitation of long-term cases involving many wasted hours in the hospital suggests that some cooperation with the educational authorities ought to be considered.

Remedial physical training should also be begun as early as possible. It is not commonly appreciated to how great an extent the general physical condition may be maintained during the period in which the patient is still in bed. There are certain contraindications such as age, pyrexia, exhaustion or pain, which preclude physical reeducation, but in many convalescence is materially shortened by the early institution of massage, assisted and resisted exercises and active and passive movements. Provided muscular contraction and relaxation are carried out systematically and under precise medical prescription the damaged structures do not suffer.

Gustav Kolischer

(Continued from page 558)

of Clarence Webster's "Human Placentation," which appeared in Berlin in 1906, clearly showing his continued interest in obstetric pathology. Among his many notable achievements was his introduction to American uroradiology of the shadowgraph catheter. He also was the first to organize urologic departments in Michael Reese Hospital and shortly after that was called to Mt. Sinai Hospital to organize a like department.

His interest in physical therapy and electrosurgery caused him to join the American Congress of Physical Therapy, which organization raised him to the presidency, and, on the creation of its gold key merit as an award for outstanding services to science, named him as one of the first in a group of seven internationally famous men of various sciences.

In life a rather impractical man, he never cared for wealth, yet, was a *bon vivant,* and became associated with prominent Americans, as in fact, he himself became so thoroughly American that events abroad touched him only lightly in contrast to many others who retained an intense interest in their native lands.

Though his friends were legion, he had few intimates, but to these his loyalty and frankness were limitless. He despised pretenders and expressed contempt for men who remained ignorant, even though they attained office in the organized profession. He continued to labor up to a few days before the effects of pneumonia laid him low in his seventy-ninth year. His memory will live long among all who knew him or his work.

ALFRED E. JONES.